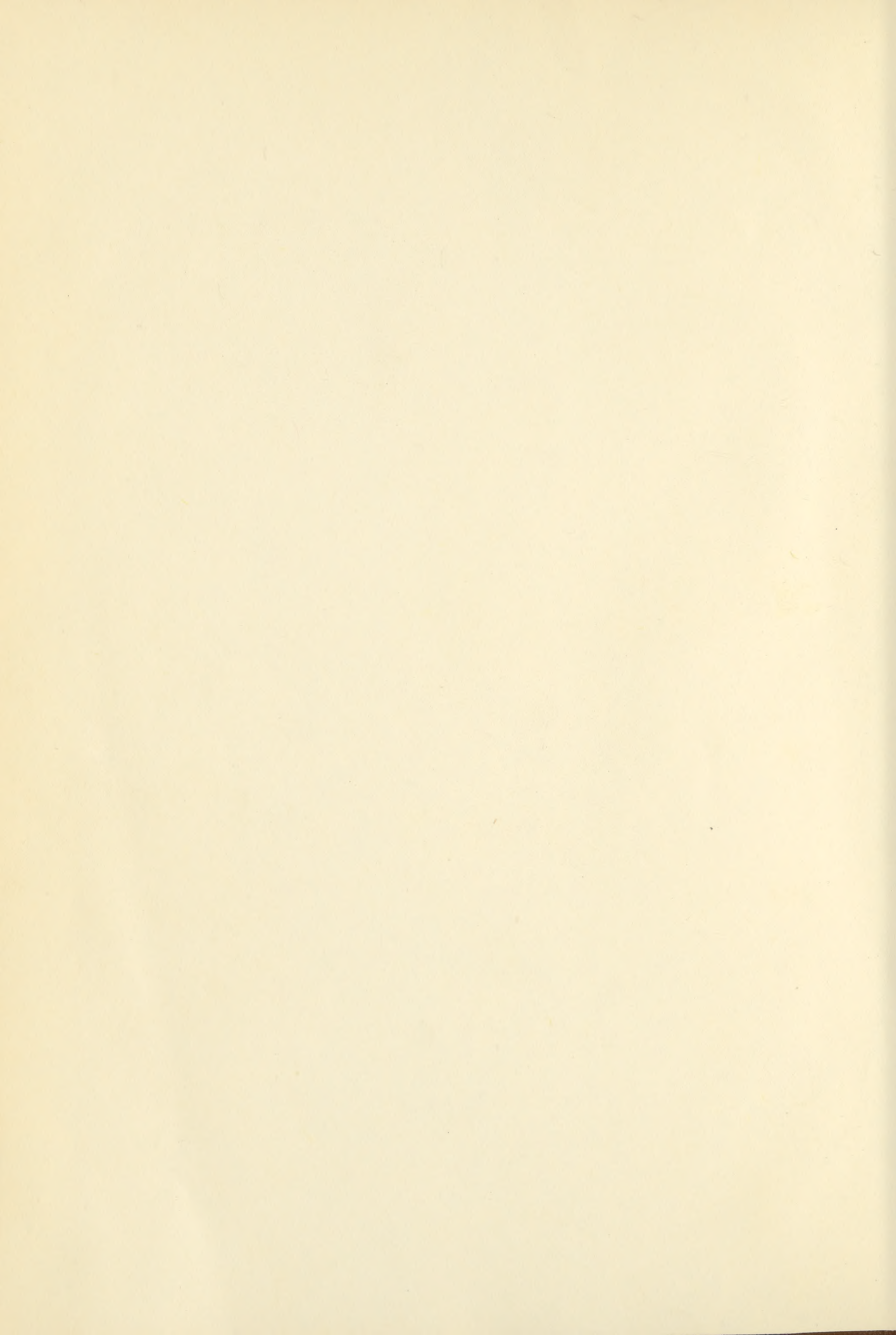








ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LXII

JANUARY TO DECEMBER, 1959

Numbers 1-6

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ANIMAL KINGDOM
NEW YORK ZOOLOGICAL SOCIETY



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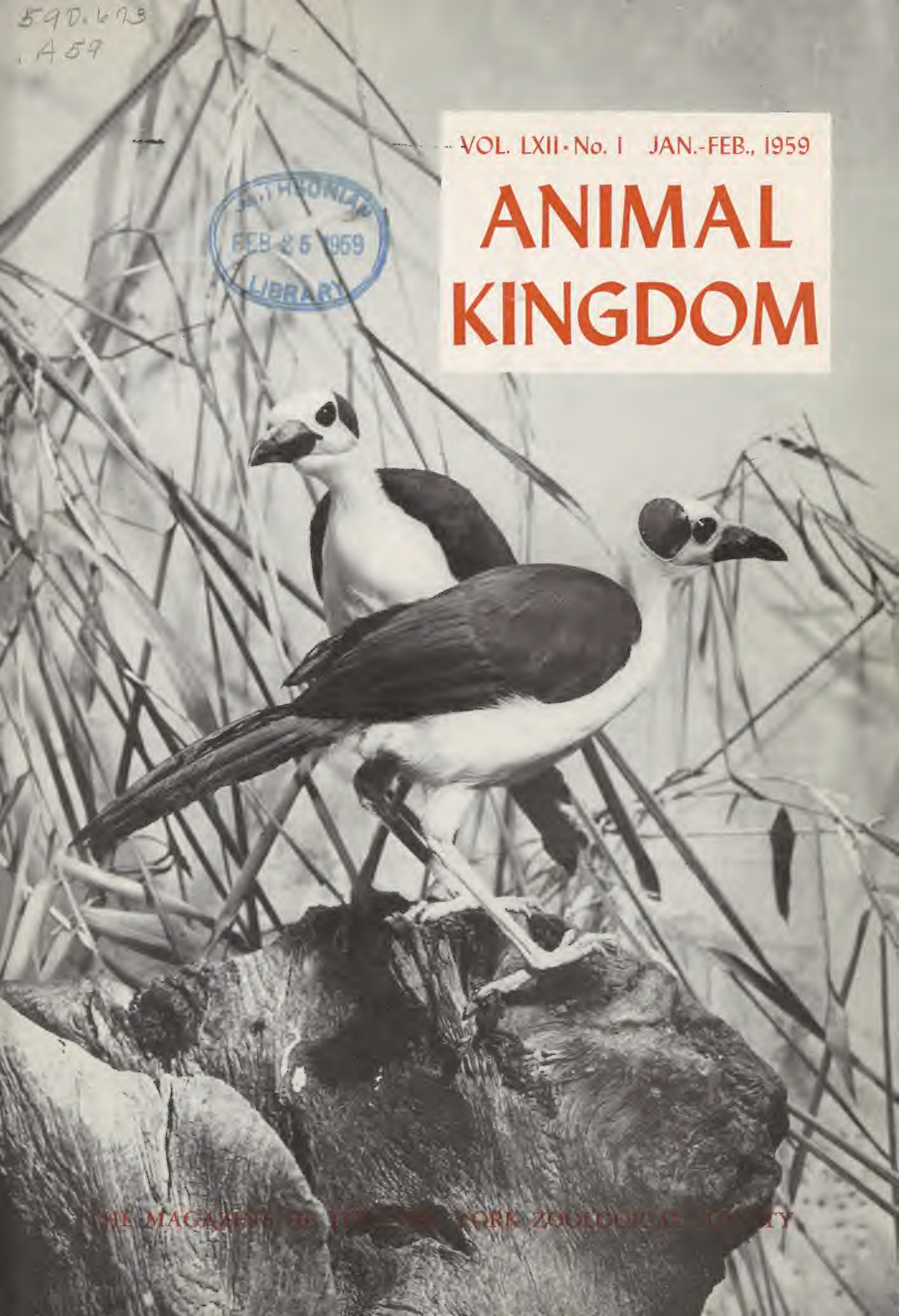
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ANIMAL KINGDOM



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ANIMAL KINGDOM

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The Arts of Nature

AN OBSERVATION made in "The President's Report" at this year's Annual Members' Meeting was not made casually. The meeting was attended by some 2,000 members and guests, a grand "turnout" indeed. Even then, many of our members could not come. Consequently, the observation is repeated here for one and all of our membership to read and think about — if they are so inclined! It is re-expressed in the form of this question: *Who is to deny that the benefits to be gained by an understanding and enjoyment of the Arts of Nature are of less importance than those of the Arts of Man?* This is not a trick question. It is a challenge. The fact is that institutions such as ours do not begin to receive the financial support accorded those dealing with human arts. There are no doubt several reasons for this, one being that works of art are very costly. But it can also be said that our needs are extremely great if we are to reach our full potential to the public, to conservation and to science.

It is a curious fact that a person, through becoming a "patron of the arts," acquires some sort of special status — even a vague guarantee of salvation in the hereafter. Yet it is well to remember that countless millions of people gain inspiration from contact with the living things of nature — the creatures in their infinite variety and beauty that represent the Arts of Nature. Innumerable people, indeed, are quite persuaded that a Gerenuk is more fascinating than a Gauguin and that Picasso at his best never created anything as engaging as a Penguin.

Fairfield Osborn

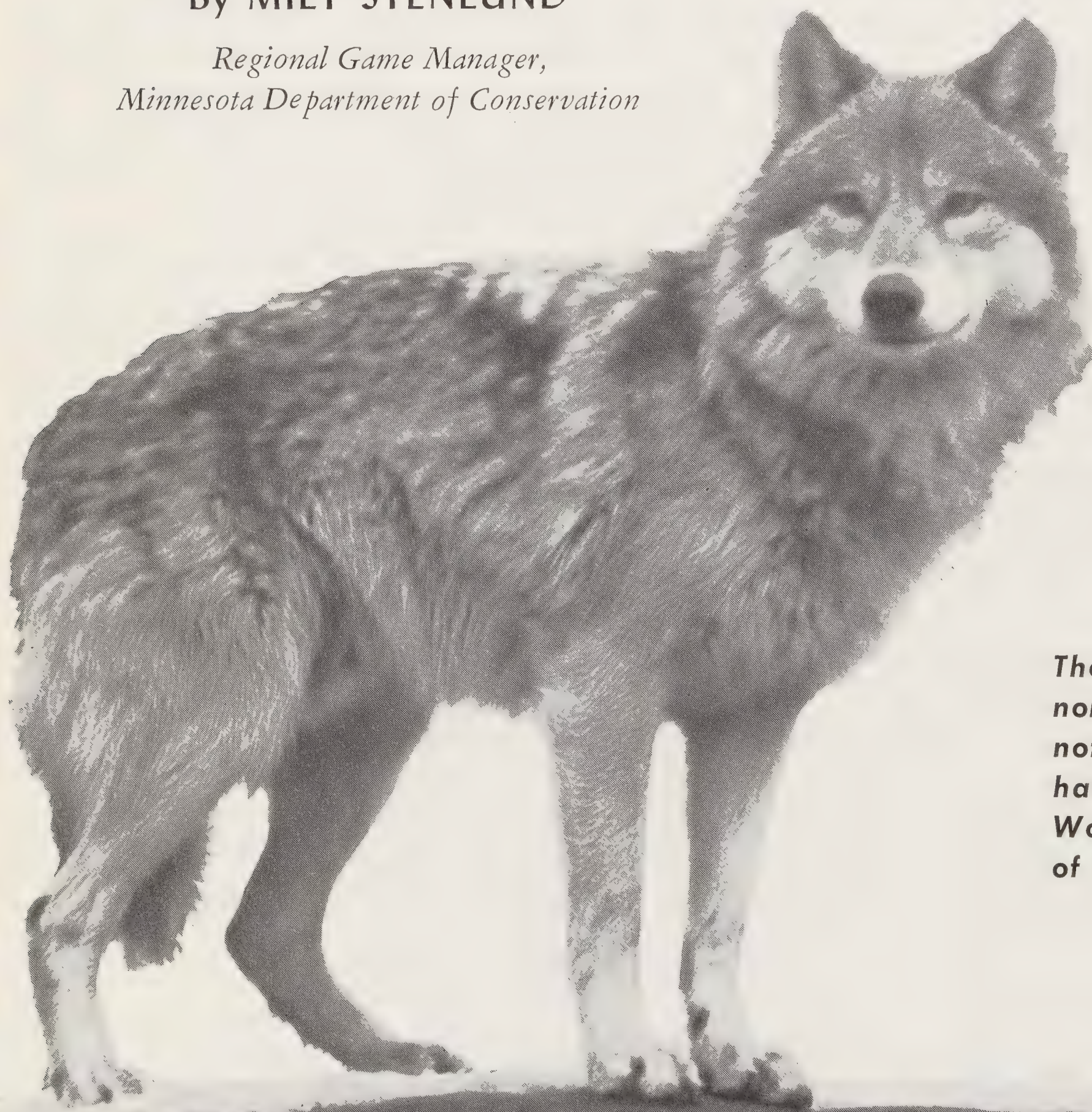
Timber Wolves of the Wilderness

By MILT STENLUND

*Regional Game Manager,
Minnesota Department of Conservation*

AS EARLY WINTER DARKNESS blotted out the shoreline, a group of six doglike shadows descended to the snow-covered lake and trotted silently across the bay. They ran in single file for a short distance, then spread fanwise like sledge dogs on the ice. As they neared the dark spruce bog on the far shore they fell in one behind the other and were gone as quickly as they had appeared. This was a pack of Timber Wolves on Lake Insula in the Superior National Forest — part of the largest concentration of Gray Wolves remaining in the United States.

The Federal Forest of over three million acres offers ideal habitat for perpetuating the existing wolf population through the foreseeable future. It is a wild and rugged area in northeastern Minnesota, a southern extension of the vast Lauren-



The Timber Wolf is neither good nor bad, except as it may or may not fit a particular ecological habitat. Right: Typical Timber Wolf habitat in the wilderness of the Superior National Forest.

Photo at right by the author

tian shield of Canada, studded with hundreds of lakes and covered with forests of pine, spruce, fir, birch and aspen. Much of the area is inaccessible except by foot or canoe. The Airspace Reservation Act signed by President Truman in 1953 prohibits airplane travel except for emergencies or official use such as patrol and fire fighting. This vast wilderness area with its absence of roads and human habitation is much to the liking of the solitude-loving Timber Wolf.

was just as effective. Even now in the far north it is common belief that the sole cause of Barren Ground Caribou losses is the wolf and that the animal should be exterminated. From the nursery to the deer hunting camp man has believed that the only good wolf was the dead one. Despite beliefs that wolves are dangerous and purposely follow human beings, waiting for the opportunity to attack, there has been no authenticated report in the United States of a wolf de-



Since the beginning of recorded history, the wolf has been a symbol of evil, an animal whose predatory habits were never compatible with man. In the West it was eliminated from most of its original range by gun, poison and trap. In the eastern states, destruction of wild habitat

liberately attacking a man without provocation. In most cases of contact the wolf was actually after the horse the man was riding or the animal had accidentally run into the person in its attempt to escape. One of the most colorful of the Minnesota wolf stories is that of the Chisago County

Swede who was attacked by wolves “and is said to have been wholly eaten up, not a bone being left, except his feet, which were gnawed down as far as the wolves could reach into his boots; only shreds and small scraps of his clothing were found.”

On the other hand are individuals who assert that predators are necessary to achieve a balance in nature and that they feed largely on sick and diseased animals, thereby keeping prey populations in a healthy condition.

Recent studies on the wolf have brought forth facts which indicate that it is neither as black as originally painted nor as flawless as hoped by some. More important than whether the wolf is good or bad is whether or not it fits the particular ecological habitat it occupies. Extensive stock raising and packs of wolves certainly are not compatible, but it is possible to have too many deer or elk and too few wolves on the same range. It is also possible to maintain reasonable numbers of large predators such as the wolf in remote wilderness areas where they compete little with big game hunters. The Superior National Forest canoe country is such an area.

During the winter of 1946-47, as a student of Wildlife Management at the University of Minnesota and during the five years from 1948 through 1953 as a Game Biologist with the Minnesota Conservation Department, I had an excellent opportunity to study the natural history of the Timber Wolf (*Canis lupus lycaon*) in the Forest.

The first white men who appeared in any numbers in the area were the French voyageurs, who carried on a lucrative fur trade in the eighteenth century. During this time and until the advent of the logger and iron miner, prey animals consisted largely of Caribou and Moose with the White-tailed Deer in the minority. The logger's axe and accompanying slash fires effected a major change in the Forest. One of the finest stands of white and red pine in the Lake States was reduced to blackened stumps and ashes. This wasteland gradually produced a lush growth of brush, aspen and birch. Only the remote canoe country along the Canadian border was spared the axe — this area was the beginning of the Superior National Forest and the undisturbed habitat of the wolf.

The extinction of the Woodland Caribou and the rapid decline in Moose numbers due to disease and gun was accompanied by an irruption in the deer herd. The new second-growth forest offered optimum food and cover for white-tails and they responded in a manner typical of the species. Luxuriant white cedar swamps, untouched by the logger, provided nutritious feed and excellent cover during long cold winters. Hunting seasons were allowed only during alternate years and a huge game refuge of a million and a half acres afforded complete protection for all game species. It was the honest belief at this time that the deer herd was in danger of extinction if regulations were relaxed.

The wolf population changed readily to a diet of deer. In the first study of predation in the area, Sigurd Olson reported packs ranging in size up to 30 animals. Despite the considerable number of wolves in the Forest, estimated by Olson at one per ten square miles, the deer herd increased to the point where starvation occurred regularly during severe winters — about once every four years. By the mid 1940s the deer herd was gradually declining due to overbrowsed range, maturing of the second growth forest and replacement of good food species by balsam and spruce. It was at this point that the study began.

During the course of the work wolves, wolf tracks and wolf-killed deer were observed in an area 45 townships in size (1,620 square miles). The assistance of Conservation Department and private planes was enlisted, along with reliable observers. More intensive work was done on the ground, traveling on snowshoes and using remote patrol cabins as headquarters. When plotting wolf activities on the map it was of interest to note that most activity occurred in areas where deer numbers were greatest — the areas which had been cut and burned early in the century. These areas provided more deer feed, reproduction in the herd was greater, consequently more wolves were attracted. In the uncut areas lying to the east and west, both deer and wolf numbers were less. Earlier records indicated that wolves and deer had been present for at least 25 years in these areas, that although deer numbers were smaller, the animals were in better balance with available winter feed. Indications were that wolves assisted in keeping deer numbers down so

that their big winter range was not overbrowsed.

Estimating wild animal populations is a difficult task at best. The wilderness area added to the difficulties in this case. Populations reported elsewhere ranged from one wolf to six square miles to one per 90 square miles. Cumulative evidence gathered in the Forest indicated a population of one wolf per 17 square miles or about 240 wolves. When additional wolf range in northeastern Minnesota is added, the estimated population reaches 300 to 400 animals on 7,000 square miles of range — the largest remaining concentration of Timber Wolves in the United States according to National Forest Service and National Park records. Although most wolves in Minnesota are confined to the northeastern corner of the state, bounty records show that the range extends west from Lake Superior for a distance of 260 miles. The major wolf range covers 12,000 square miles and is closely affiliated with the remote conifer forest cover. The Coyote (*Canis latrans*) is also found in this area but is actually outnumbered along the Canadian border.

Winter food habits were determined by examining 67 stomachs taken from wolves shot, trapped or snared during October through March over a five-year period. Sixteen stomachs were completely empty. Remains of White-tailed Deer were found in 80% of the stomachs and made up an amazing 96% of the volume of food analyzed. In most cases deer remains were chunks of fresh venison swallowed whole. The wolves ate little carrion, preferring to make fresh kills when hungry. The only other animals found were Snowshoe Hare, 8% by occurrence and 1% by volume; Porcupine, 8% by occurrence and a trace by volume; Ruffed Grouse in 6% of the stomachs and 3% of the diet by volume. Although only four prey species were identified in the food analysis, field observations showed wolves also made kills of Mink, Otter, Moose and Beaver.

The unimportance of small birds and mammals in the winter diet was further emphasized by census studies on grouse and examination of parasites in wolf intestines. Grouse census studies showed that bird populations were low in 1946-47 and high in 1951-52. Incidence of grouse in food analysis did not increase significantly with the increase in bird populations.

Examination of parasites in the intestines of 18 wolves failed to disclose a single specimen of the rabbit tapeworm (*Taenia pisiformis*). The larval stage of this parasite is commonly found in Snowshoe Hares.

A small number of summer droppings were examined and found to contain deer remains along with the bones of small mammals. The study showed conclusively that the White-tailed Deer is the mainstay of the winter diet of the wolf in northern Minnesota.

A total of 144 wolves was weighed during the winter period, November to March. Although local stories persisted of wolves weighing up to 150 pounds, the largest animal, a male, weighed 112 pounds and measured 69 inches. The largest female weighed 80 pounds and measured 61 inches. These are still good-sized animals when compared to domestic dogs.

Actual observations were made of 318 wolves during 800 flying hours. Contrary to public opinion that most wolves run in packs, single wolves made up 43% of all observations. One pack of twelve was seen from the air and a pack of 15 tracked across Nina Moose Lake. These were the largest recorded. Others ranged in size from two to ten. Home ranges were also established for certain packs and it was noted that other wolves respected these boundaries to a certain extent. When a small pack was completely eliminated by plane hunters, wolves from the surrounding area did not usurp the abandoned area for a period of three weeks although they continued to hunt the edges. This respect of home territory is believed to be one factor limiting the number of wolves on a specific area.

Another commonly accepted belief is that wolves travel in pre-determined circles almost as regularly as a policeman on a beat. Attempts were made to follow packs over a period of time to determine if a circuitous route was actually followed but all failed. Wolf tracks wandered aimlessly at times, mingled with other packs, or were covered by fresh snowfalls. In one instance a pack traveled 35 miles overnight in a rough semicircle. In another a pack was followed for ten miles in a semicircle, when the trail was lost. This interesting problem remains to be solved.

Wolves do depend, however, on topographical



The author with remains of a White-tail doe killed by wolves. Only hide, bones and paunch were left. Deer comprised 96% by volume of wolf stomachs studied.

Photo by the author

features of the land for travel routes and use these same trails repeatedly. It is here that the trapper makes his sets, reasonably sure that wolves will return in a week or two or three. While setting wolf snares in the Star Lake area in 1937, I located an ideal spot for a snare; a narrow creek gorge, a well-defined wolf trail and a convenient balsam tree trunk with overhanging branches. When attempting to place the snare around the trunk I found the rusted remains of an old homemade wolf snare, proof that other trappers had found the spot suitable in years gone by.

River and creek valleys, long ridges, portage trails, and islands are favored travel routes. The desire to travel appears to be an inherent trait. Wolves often travel for miles, completely disregarding fresh prey sign which crosses their path. Instances were noted in which wolves actually trotted through deer "yarding" areas without deviating from the trail. When the time to feed approaches, however, speed and cunning come to the fore. A single wolf is capable of killing an adult deer. It attacks by biting at the neck, head, shoulders and flanks, often knocking the deer down two or three times before it is killed. No evidence of hamstringing was found.

When hunting as a pack it is evident that individuals communicate in some manner. In two instances hunting packs divided, part of the group driving across an island or a point search-

ing for prey while the remainder of the pack ran swiftly along the ice to await the flushed prey as it left land. In both instances a deer was killed by the waiting wolves as it was driven from the protection of the timber.

It has been widely believed that wolves generally cannot outrun deer but must outlast them in a long chase. An actual chase by game wardens showed that wolves are capable of speeds up to 35 miles an hour and that they can catch deer in a relatively short distance. Although there are instances where wolves have missed in a kill and have given up a chase, usually they make successful kills of deer without undue effort. In some cases where wolves were driven from freshly killed deer it appeared that the deer had died from a combination of fright, shock and exhaustion rather than the superficial wounds they sustained.

Because of heavy cover and rough topography, wolf dens were extremely difficult to find. I have examined only one, although others were reported in rocky cliffs and hollow logs. The one examined consisted of two good-sized tunnels dug into a sandy, south-facing slope in a thicket of balsam fir trees. Four smaller holes, apparently dug by pups, were scattered about fifteen feet from the main den. This den was used at least two springs and then abandoned. The next year a fox was trapped at the entrance to one of the smaller tunnels.

Reports on eight wolf litters were received. They ranged in size from four to nine and averaged just over six.

Apparently the only important decimating factor affecting wolf numbers is man himself. A bounty of \$35 per animal is paid in Minnesota. The bounty kill plus a small number taken by Conservation Department personnel approximated 40% of the population annually. Since the wolf population remained relatively stable during the period of the study it is believed that the effect of the bounty was merely to harvest surplus animals.

Experiences using poison on Coyotes in the West have shown that 60-70% of the population must be removed annually in order to effect any reduction in over-all numbers.

Of 156 wolves taken during the study period, 100 or 64% were males and 36% were females. It is believed that wolves do not breed until their second year but it is not known if all wolves breed every year or how many non-breeding animals are found in a pack. These possibilities, along with the small number of females in the population, tend to hold wolf reproduction down. This is believed to be a method of natural control, since the wolf has no larger predator to fear.

A total of 82 wolf-killed deer was examined in the field. Since the sex ratio was 100 males to 100 females and deer hunter kill statistics are similar, the figures indicate no preference by the wolves for either sex. Hunter statistics also show that fawns make up about 30% of the annual kill. Fawns made up 26% of the wolf kills. This indicates no preference for fawns over adult wolves.

The ages of 36 wolf-killed deer were determined by examination of the teeth in the lower jaw. Of eight adult deer only two were six years old or older; all others were in the prime of life. There is no indication that wolves tend to take older deer in preference to prime animals. Although the number of diseased or crippled deer among those killed by the wolves is unknown, it is believed to be negligible. Little hunting by human beings is done in the wilderness areas to produce cripples and Minnesota white-tails are free from serious disease and parasites.

How many deer do wolves kill and just what effect do they have on the general deer popula-

tion? No single wolf or pack could be followed long enough to establish definite total kills but from evidence gathered of kills during the study it was estimated that a pack of three wolves killed a deer every four days. This approximates 3,000 deer killed by the 240 wolves during November through March period on 4,100 square miles of the Forest. Another 3,000 are probably taken during the remaining seven-month period, or an annual take of 1.5 deer per square mile.

Deer census drives conducted in 1939 showed an average population of 12 deer per square mile. It is believed that the present population is close to nine per section. The wolves, then, take about 16% of the herd each year. Hunting checks made in accessible areas show hunters only remove one deer per two square miles. The wolf, therefore, harvests more deer than the hunter, although both only take 24% of the herd. This is less than the annual increment. In some areas wolves undoubtedly kill deer which could offer targets to hunters, but in most of the remote areas the deer will never hear the report of a hunter's gun. Intensive wolf control in these areas would serve no good purpose since animals saved would not be harvested by hunters but could increase to the point where their numbers would destroy the range through over-use. It is this area where a reasonable number of wolves should be maintained, for here they do not conflict with human interests and their presence actually adds to the wilderness aspect.

Under the present management policy of the United States Forest Service, predator control is discouraged unless well-founded reasons are presented. Protection is also offered to save animals such as the wolf and the Fisher because of the tremendous increase in the recreational value of the area.

The Minnesota Department of Conservation has also recognized the importance of maintaining reasonable numbers of large predators. Department personnel no longer practice predator control in the remote areas. The continuation of these policies will insure that the wolf will be an integral part of the wilderness. Its lonely howl will remind travelers that a great part of the history-laden Forest remains much as it was during the days of the earliest travelers — the Indian and French voyageur.



Red-throated Caracara—

THE SCOURGE OF THE WASPS

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

One of the mysteries of the feeding habits of the Red-throated Caracara is why it is not unbearably stung on the bare skin around its head when it attacks a nest of the “guitarron” wasps. It seems to disregard the wasps that buzz around.

Drawings by Lloyd Sandford

Cacáo ca ca ca cacáo sounded loudly far above me as I wandered through primeval forest in the middle of the Isthmus of Panama. My head far back, I peered into the crowns of the majestic trees until I caught sight of the author of these alarming cries, resting high up on a leafless bough. It was a large, long-tailed, hawk-like bird, nearly everywhere black with a blue-green gloss, except its snowy white abdomen and under tail-coverts. In contrast to the plainness of its plumage, its featherless parts were vividly colored: its naked cheeks were deep crimson, its bare throat red, its bill yellow with leaden blue cere, its legs bright orange-red. From the description I then wrote, I identified this bizarre bird as *Daptrius americanus*, the Red-throated Caracara, a peculiar member of the falcon family.

While I watched, the caracara changed to a different call, no less raucous than that which

had first arrested my attention. Its cries now reminded me of the loud, harsh, forced laughter of a boorish person in a derisive mood. It repeated this rude *ha ha ha* over and over, all the while holding in its bill something which resembled a fragment of brood-comb from a wasps' nest. After I had examined it carefully through my binoculars, the noisy bird flew off over the tree-tops and vanished, but I continued to hear the raucous cries that had at first startled me.

The following year, when I dwelt in a narrow valley amid the high mountains of southern Costa Rica, I learned from the country people to call this hawk the “cacáo”—an excellent rendering of its loud call. At the beginning of the dry season in December and January, when evidently they were forming pairs and preparing to nest, these birds were especially noisy, frequently shouting raucously from the tree-tops. In January, I watched a lone cacáo who perched on a

dead branch, as usual high above the ground, and acted in a ludicrous fashion, flapping its black wings loosely about its body as it uttered a variety of unmelodious cries. During the remainder of the year the caracaras were less noisy and conspicuous, but they always drew attention as with labored wingbeats they flew high above the valley from forested ridge to forested ridge, calling *ca ca ca cacáo* as they went. Often three travelled together, but I have never seen caracaras in larger flocks.

Another remarkable creature with which I became familiar in southern Costa Rica was a large, blackish wasp, which attached its conspicuous nests to the trunks and thicker branches of trees and not infrequently to the walls of houses. These vespiaries, sometimes reaching four or five feet in length, are enclosed by a stout envelope of gray or brownish carton, strengthened by pronounced transverse corrugations. The wasp, a species of *Synoeca*, was well known to my neighbors, who called it the "guitarrón," probably because the cross-markings in the walls of its nest reminded them of the fretted handle of a guitar.

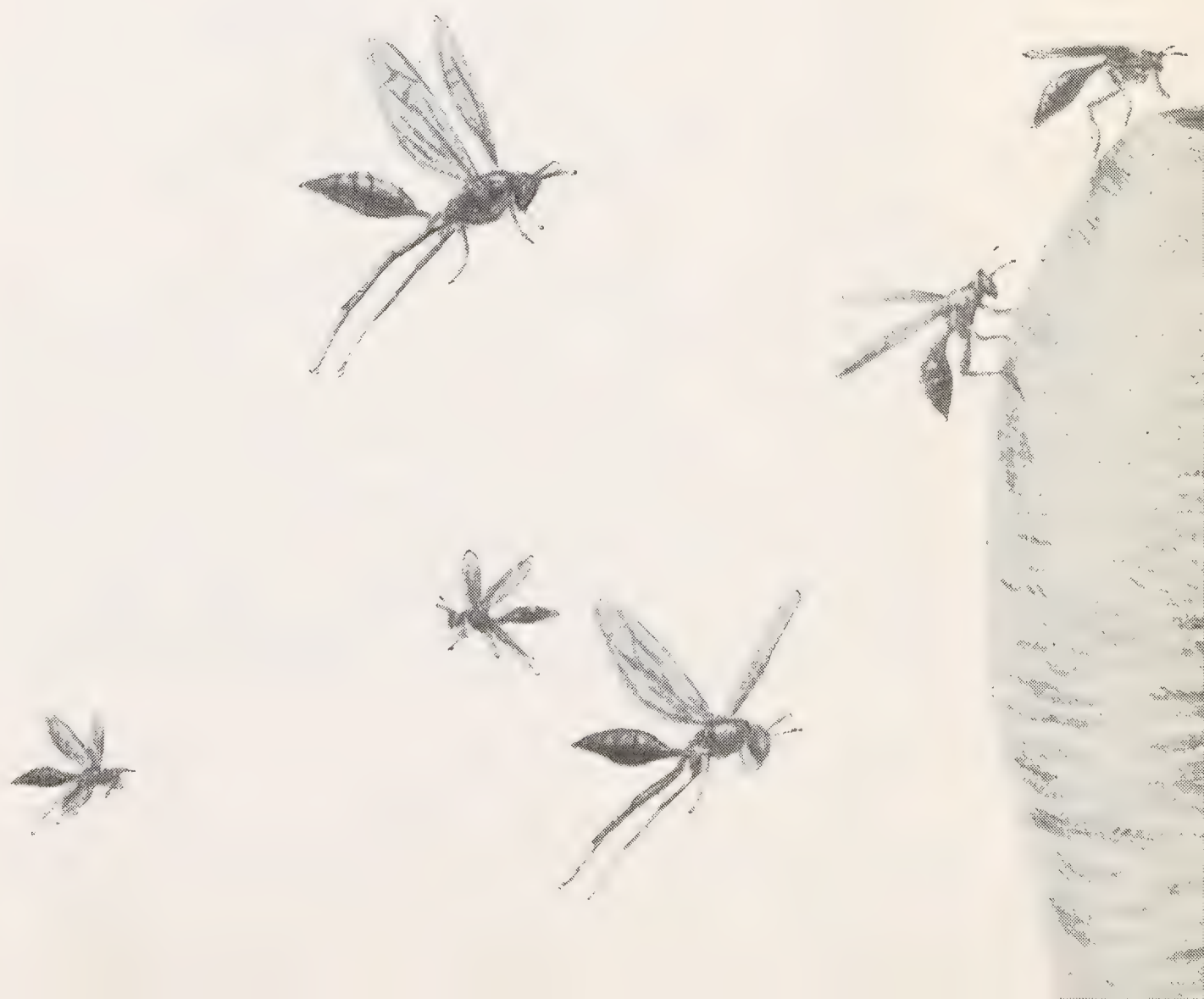
The guitarrón wasps won my admiration and respect one year when they shared the rough, unpainted cabin which I rented in the Valley of El General as a base for my field work. Early in February, a swarm of them settled down and proceeded to build on one of the pillars that upheld the tiled roof at a corner of the little front porch. When neighbors warned us that these wasps have a most painful sting, my companion, a young entomologist, advocated that we follow their advice and smoke them out. But I argued in their favor, pointing out that it would be interesting to follow the construction of the nest. We finally agreed to permit them to remain as long as they preserved the peace.

They built their hexagonal brood cells in a single layer, securely attached to the surface of the wooden post, and at the same time they set about constructing the envelope to enclose them. For building material they tore fine fragments from decaying or even sound wood, making considerable noise as they attacked the edges of softwood boards with their strong mandibles, and they somehow cemented these bits together, possibly with a secretion from their mouth parts. Beginning at diagonally opposite corners of the

square pillar, they at first built the corrugated walls outward, but soon they made them curve inward, until the edges of the two sheets of carton approached each other above the center of the nest. It seemed to me that even a man, given ruler, calipers and other measuring devices, would have difficulty in bringing the two sides together while preserving the smooth sweep of the original curves, but without any aids of this sort the wasps accomplished this perfectly, finally cementing the two sheets tightly together along the middle line, about ten days after they began to work.

After the envelope was completed, the only entrance to the vespiary was through a round opening, about an inch in diameter, at the end of a short spout at the top of the nest. If the community prospers and grows, the guitarrón wasps enlarge their nest by building at the top a similar section, the lower end of which overlaps the doorway of the older part, and such additions may be made repeatedly. The enclosed portion of the next older segment is then removed, with the result that the nest always consists of a single elongated space containing a continuous sheet of brood cells and entered through a single aperture at the upper end. But irregularities in the outer wall enable one to count how many times the structure has been enlarged.

The wasps on our porch never stung us, thanks largely to the signals which gave us ample warning that we were annoying them. If we engaged in some noisy occupation close by, or experimentally struck the supporting post, those within the nest produced a loud rustle by vibrating their wings and perhaps also by striking them against the enclosing carton, which acted as a resonance box to intensify the sound. If the disturbance





were continued, they sallied forth to defend their citadel with long stings barbed like those of the honey bee — a formidable weapon such as few wasps possess. Even at dawn, when after a clear night in February they were too cold to fly, our wasps whirled their wings threateningly and came pouring out if their nest were molested. But they could then only crawl stiffly over the outside, and those that attempted to fly beat their wings so slowly that they fell ignominiously to the ground, where they lay helpless until after sunrise, when rising temperature made them more active. Thus we and our guests preserved a sort of armed neutrality over a period of nearly five months.

It requires years of patient observations to become familiar with a few of the multitudinous creatures of the tropics, and even more slowly does one discover some of the interactions between them. The scene again shifts to the fourth of my abodes in the Valley of El General, the farm where I have dwelt for the last eighteen years. When I settled here, there was a large

nest of the guitarrón wasps attached to the lower side of a thick, ascending branch of a Spanish plum tree that grew near the forest's edge, not far from the house I was building. One afternoon in November, loud, hoarse, raucous cries drew my attention to a caracara standing on the base of the branch that supported the vespiary. The bird had somehow made two small punctures in the carton wall, and while it rested there the big, angry wasps swarmed around it. Some apparently attached themselves to its plumage, for it shook its head, scratched its body with a foot and seemed to pluck one or two from its feathers. But on the whole it did not appear to take much account of the insects. It was clear that its chief problem was to make a breach in the citadel's wall, not to avoid the attacks of its defenders. When the big bird bent far over the side of the stout branch to peck at the side of the wasps' nest, it would slip down and regain its balance with difficulty. But finally it succeeded in making the holes large enough for its purpose.

Now, clinging back downward below the wasps' nest with its toes in the perforations it had made, the caracara began to tear large, papery flakes from the upper part of the corrugated envelope of the hive. Soon its head was inside, hidden from my view, but I had no doubt that it was enjoying a feast of tender white larvae and pupae. White belly upward, tail half spread, wings partly open and hanging in random attitudes, the caracara reminded me of a dead hawk hung up by a gamekeeper to frighten away others of its kind. It kept the merest toe-hold on the edges of the perforations in the side of the nest's envelope, and I was amazed that carton so thin could sustain in this fashion a bird so large and heavy. From time to time the caracara would shift its position, tear away more of the nest's covering, always working downward, then again bury its head in the interior, to proceed with the feast. I now judged that I could advance closer without risking the interruption of the process

It was on a Spanish plum tree at the edge of this forest in the Valley of El General in Costa Rica that the author first saw a Red-throated Caracara tearing holes in the wasp's nest and eating larvae.

Photo by the author

that I was eager to study. Through my binoculars, I could clearly see the big wasps hovering around the despoiler of their home, but they preserved a slight distance from it and none alighted on its glossy, blue-black plumage. Many were already settling down on the surrounding foliage.

When, proceeding in this fashion, the caracara reached the bottom of the nest, it experienced greater difficulty. Its foot-hold gave way and it fluttered down into the bushes on the slope below the Spanish plum tree. Then it flew off to perch in a tree in the neighboring pasture, but after a brief rest it returned to the attack, uttering its raucous war-cry. Again its footing failed before the meal was well resumed; it fluttered down, flew off to perch and rest, then promptly, with renewed shouts, returned to the vespiary — with precisely the same result as before. Seven times the caracara attempted to cling to the nest, only to have its toe-hold promptly break away. Apparently this lowest part of the corrugated envelope, being oldest, was not as tough as the newer portions toward the top. At last becoming

discouraged, the noisy bird flew to the tall trees beside the river, to rest and digest its meal.

It had left very little that was edible in the vespiary. All the brood cells, save a few in the lowest part of the nest, were open and empty. A whole city of wasps had been destroyed to supply one meal for a caracara! The insects still crawled dispiritedly over their pillaged domicile, but I had little doubt that, like the companions of Aeneas after the sack of Troy, they would re-establish their city in a new site.

The black swarm migrated only about fifty yards to the front wall of my house, where they added another type of structure to the fascinating variety of wasps' nests that already made the walls and rafters of my recently built home interesting to a naturalist. Some of these vespiaries were from time to time torn open for their larvae and pupae by wintering Summer Tanagers from the North, who plied the same trade as the caracaras but on a more modest scale. I never saw one of these shy red visitors molest a nest of the guitarrón wasps. But the latter were not immune from the attacks of the army ants which periodically swarmed over and through the house, driving most of the smaller wasps from their nests, and carrying the white grubs down the walls and out across the dooryard in their endless streams of hurrying marauders. When the *Eciton* ants attacked the guitarróns' nest by day, the big, black wasps lined up inside their doorway, with heads just visible in the aperture, and pushed back the attackers, without — so far as I could see — the infliction of injury by either party. When the ants succeeded in opening a small breach in the carton, the wasps defended the gap in the same way.

But by night the diurnal wasps were no longer a match for the sightless ants, which work equally well in light or darkness. One night the guitarróns flying in to my lamp apprised me that something had gone amiss with their nest, and going out with an electric torch I saw that the army ants had invaded the vespiary. For hours thereafter they filed down the outer wall of my dining room bearing heavy white burdens — the same food that the caracaras preferred. Even many of the adult wasps were trapped by this nocturnal raid and carried out by as many ants as could take hold of them, marching at a snail's pace.



bird with its foreparts in the vespiary was taking punishment as the price of a meal, the other had no motive to remain so near the angry swarm. The fact that it stayed there was rather convincing evidence that the insects were not hurting it.

A little later, two of the caracaras were at the wasps' nest, while the third waited close by. These social birds share their feasts. The garrulity of the caracaras and other hawks which do not prey on birds, including the Laughing Falcon which subsists largely on snakes, and the Large-billed Hawk that catches lizards, contrasts

Tree ferns at the edge of the rain forest in Costa Rica. It was near here that the author made many of his observations.

Photo by Don R. Eckelberry

Mr. Skutch (left) is an authority on Costa Rican birds. With him at the Skutch home is Don Eckelberry, the animal artist.

Photo by Mrs. Skutch

After the ants had withdrawn with their spoils, the surviving wasps returned and replenished their empty cells with a new brood.

Although I found a number of nests of the guitarrón wasps which had been torn open, apparently by caracaras in the manner I had witnessed, eight years passed before I again saw the avian plunderers in action. Walking through a pasture one afternoon in early December, I found three of the noisy birds in a Spanish plum tree that supported a very large nest of these wasps. As I came into view, two of the caracaras flew into a neighboring grove but one continued to tear open the corrugated covering of the vespiary. Soon another returned and perched a few feet from the nest and its feasting companion. The spectator raised a great outcry, calling *cacáo c' c' c' c' cacáo cacáo . . .* as it loosely shook its wings in ludicrous fashion, and meanwhile the third member of the party was equally vocal within the grove of trees. A swarm of enraged wasps buzzed around both of the caracaras in the Spanish plum, but the birds took little notice of the insects, which would have stung a man beyond endurance. From time to time the resting caracara scratched its head, possibly to dislodge a wasp that I could not see. Although conceivably the

strongly with the dour silence of those fiercer hawks which strike down other feathered creatures.

When we see an animal preying on some powerful creature or one with formidable weapons, as the caracaras on wasps and the Laughing Falcon on serpents (and sometimes venomous ones), we are at first amazed by their temerity and the risk they incur. A little reflection, however, makes it clear that the risk must be exceedingly slight. Since most animals eat at least once daily, if these predators were seriously injured by their particular prey as often as once, on the average, in every hundred encounters, few would survive to reproduce their kind. They are of necessity specialists so well equipped for their hereditary mode of life that they run scarcely any risk — although even in the safest occupations of free animals, no less than of men, accidents sometimes occur, as when an Osprey sinks its talons deeply into a fish large enough to pull it beneath the surface and drown it.

No less surprising to me than the caracara's boldness in attacking the guitarrón wasps was the failure of the latter to put up a more effective defense of their home and immature offspring. Certainly only a pusillanimous creature refuses to

employ powerful weapons to protect its young. But the wasps' apparent cowardice is the counterpart of the caracara's assurance in plundering their nest. If the bird were not master of the situation, it could not afford to take the risk of molesting the vespiary; because the bird is clearly master, the best defense that the insects could make would be ineffective. Since they will inevitably lose their larvae and pupae, it is to the advantage of the species that the adults refrain from futile attacks and preserve their lives to rear another brood.

We do not know the stages by which the ancestral caracaras developed their peculiar mode of life and acquired their apparent immunity from the stings of wasps. Doubtless there was a time when to molest the hive of the larger stinging hymenoptera was for a caracara a precarious



undertaking, possibly to be done only under the stress of hunger in times of scarcity. At this stage the wasps might often have put up an effective defense. But as with the passage of the generations the caracaras became better adapted to this

mode of foraging and the insects' attacks less often availed to save their nests, those which desisted from stinging the bird survived to reproduce their kind, those which foolishly strove to defend their brood were exterminated. Natural selection set a limit to their parental devotion; and this process was probably accelerated by the circumstance, noticed by Phil Rau, that the barbed stings of guitarrón wasps become so firmly embedded in the victim that the insects cannot release themselves without tearing away part of their viscera. At the present time, the wasps' attacks are effective against occasional disturbers of their nests, not against professional plunderers like the caracaras. And since animals in their hereditary environment do not, unless at times of dire need, try to procure food by perilous means, it seems likely that the guitarrón wasps rarely employ their powerful stings, except now and then to send off some blundering animal which has no intention to harm them, but fails to heed the insects' warning whirr.

After I had watched the caracaras pillaging the nests of the wasp most dreaded by man in this region, to find them preying on the far smaller potter wasps was an anticlimax. These little wasps covered with black and yellow bands attach their curious nests to slender twigs of trees in dooryards, orchards, shady pastures and other places outside the forest. Roughly the shape of a pear, brownish in color and rarely as much as nine inches in length, these structures are enclosed in a thin envelope of clay so treated that it does not dissolve beneath the heaviest rains. The narrow round opening, at one side of the bottom, is always guarded by a number of striped heads looking out. In plundering these vespiaries, the caracara follows a procedure which would hardly be applicable to a guitarrón's nest. After tearing off the clay bottom of the urn, it detaches one of the flat combs which the *Polybia* wasps build, layer above layer, in its interior. Carrying the comb up to some high branch, the bird holds it down with a foot while with its bill it pulls the structure apart and extracts the larvae or pupae.

I have not succeeded in learning anything about the breeding of the Red-throated Caracara. Apparently it nests high up in the great trees of the tropical rain-forest, which guards its secrets no less stubbornly than the depths of the ocean.

The Rare and Elusive Picathartes

By WILLIAM G. CONWAY



IN THE WESTERN PART of Africa — the Cameroons, Sierra Leone, Togoland and the Gold Coast — live two species of a strange, rare bird called "Picathartes." On January 8 the New York Zoological Park became the first zoo in the Western Hemisphere to possess these rarities.

The Picathartes, so rare that no really good common name has been designated for it, has been an exhibition objective for a long time. Rarities, of course, receive this designation for many reasons. A bird may be common in the wild, but possess such specialized behavior or physical apparatus that its practical display in a zoo is an extremely difficult undertaking. An example is our native Chimney Swift, which feeds on the wing and has feet modified for specialized clinging. Some highly desirable species have flying, roosting or other behavior characteristics that make them exceedingly difficult to catch, and

Some birds are rare but not at all striking in appearance. Picathartes, with its yellow head and bold black spots, is not only a great rarity but is unusual enough to catch attention.

still other birds live in remote, inaccessible areas. The two species of Picathartes seem both difficult to catch and rare in the wild state. However, they seem to adapt to cage life well and present few special care problems in the Zoo.

Three birds came to us. All are *Picathartes gymnocephalus*, sometimes called the White-necked Picathartes. They are somewhat smaller than a crow and their heads and the backs of their elongated flexible necks are bare of feathers. The naked head carries two sharply defined black oval spots, as though they wore ear muffs. The bird seems to wear a tight, strikingly-patterned rubber bathing cap. The Gray-necked Picathartes

(*Picathartes oreas*), as its name implies, has gray rather than white neck feathers, but differs more importantly in the colors of its strange skull cap — blue, black and bright pink.

The first *Picathartes* successfully exhibited in a zoo was one of the gray-necked species, a specimen brought out of Africa by the famous collector Cecil Webb. While he was collecting in the British Cameroons in 1948, a native boy brought him a *Picathartes* that had been captured in a noose set for Brush-tailed Porcupines. Considering the violent action of the usual sort of animal noose, it was great good luck that the bird was not injured. Webb fed it with a variety of large insects. Eventually, after careful exploration, he discovered a small *Picathartes* nesting area nearby. Despite many hard, wet days in the forest setting nets and traps, he was unable to catch more of the wary birds, but the story of these efforts makes a fascinating chapter in his book, "The Odyssey of an Animal Collector."

Tragedy very nearly overtook Webb's *Picathartes* when a column of driver ants descended upon his compound. Unable to escape the ant swarm, many of Webb's birds were killed before the attack was discovered, but somehow the voracious army missed the *Picathartes* in the first onset and it was saved, and the London Zoo, for which Webb was collector-curator, became the first zoo to exhibit a live Gray-necked *Picathartes*. Two years later, in 1950, the first specimens of the White-necked *Picathartes* were collected in Sierra Leone, but they failed to survive the arduous trip back to civilization. It was not until December of 1954, when the BBC and the London Zoological Society sent an expedition to Sierra Leone, that a White-necked *Picathartes* was again captured, and this specimen was successfully acclimated to captivity and made the first public appearance of the species at the London Zoo. Several more *Picathartes* have been captured since then. Last year a zoo in Holland joined the London Zoo in exhibiting a species, and this year at least five more White-necked *Picathartes* have made their way out of Africa; of these, three now live in the Bronx.

Picathartes present problems to bird systematists as well as to collectors and zoos. Originally, the two forms were referred to as Bald Crows, for it was thought that their nearest relatives were

among the magpies, crows and jays. The name "Picathartes" means, literally, a magpie cleanser and implies a magpie-vulture. In 1938 Dr. Percy Lowe, after evaluation of the birds' characteristics, noted their similarity to certain Asiatic starlings, but a few years later Dr. Dean Amadon of the American Museum of Natural History raised serious technical objections to such a classification. In 1951 Delacour & Amadon pointed out *Picathartes*' affinities with the thrush-babblers. Thus, at present, the group is classified in its own Subfamily under the aegis of the babblers, or is given full Family status itself.

So far both species of *Picathartes* have kept the details of their life histories well hidden. Even their voices are not well recorded, although the BBC taped an "extraordinary grunting cry" from the white-necked bird. Certainly very little has been recorded of their courtship habits, and it is fascinating to speculate on the use, if any, of the grotesquely-patterned head in courtship display. We do know, of course, that males and females are patterned alike (which means that we cannot be sure of the sex distribution in our birds), and some observations indicate that both parents feed the young at the nest. It has been shown that they feed upon insects, crustaceans and even small amphibians in the wild. Several reports indicate that, like many other birds, *Picathartes* makes use of the bounty of small fleeing creatures which always precede the march of Africa's voracious driver ants.

Both species live in rocky, densely-forested areas, usually near streams. The BBC expedition reported finding the white-necked kind "nesting among rocks in the depths of the forest high in the hills, the rocks being immense granite boulders one hundred feet and more in diameter scattered among the trees." The nests were cup-shaped and constructed mostly of mud. The descriptions indicate a nest like that of an American Robin, but plastered, swallow-fashion, against a rock, perhaps in a crevice, six to fifteen feet above the ground. The eggs are said to be two in number, of brownish color and covered with dark brown scrawling marks.

Our three birds are now on exhibition in the Bird House, and if they continue compatible, we shall have a wonderful opportunity to learn some entirely new facts about their behavior.

Zoo News In Pictures

Photographs by Sam Dutton



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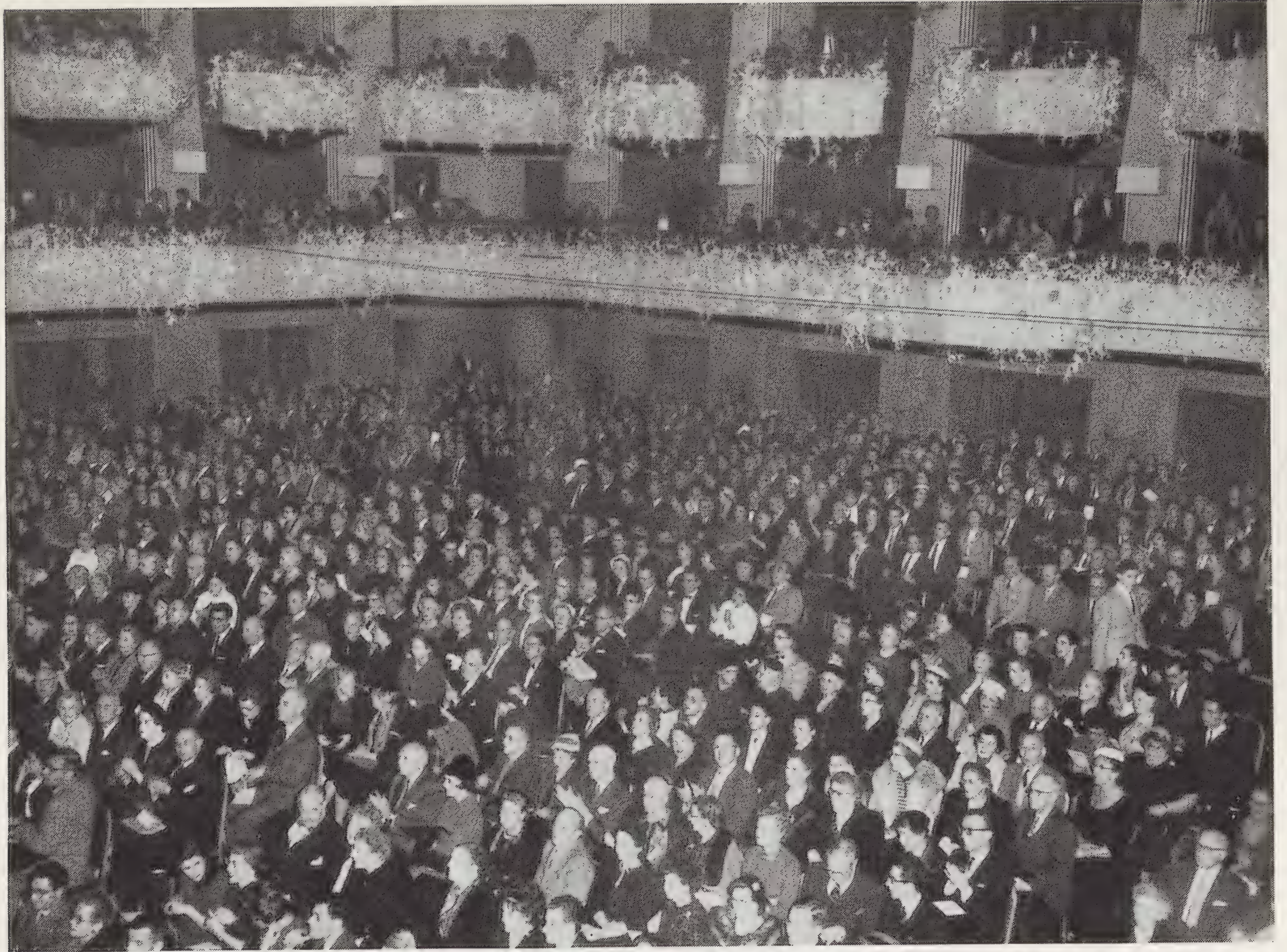


and weighing of the large reptiles in our collection of the Reptile House in mid-January and was an incident, although there were one or two lively **INDIAN ROCK PYTHON** was being handled. **OLIVER** at 14 feet 1 inch, and it weighed 117 pounds. The largest of two **ALLIGATOR SNAPPING TURTLES** was when it came to us in 1952. In January it was measured 48 inches from nose to tail. The **ALLIGATOR SNAPPING TURTLE** of the Gulf Coast of the United States, is the largest and has been recorded at 200 pounds.

Top photo by Eichorn—Newsday—Long Island



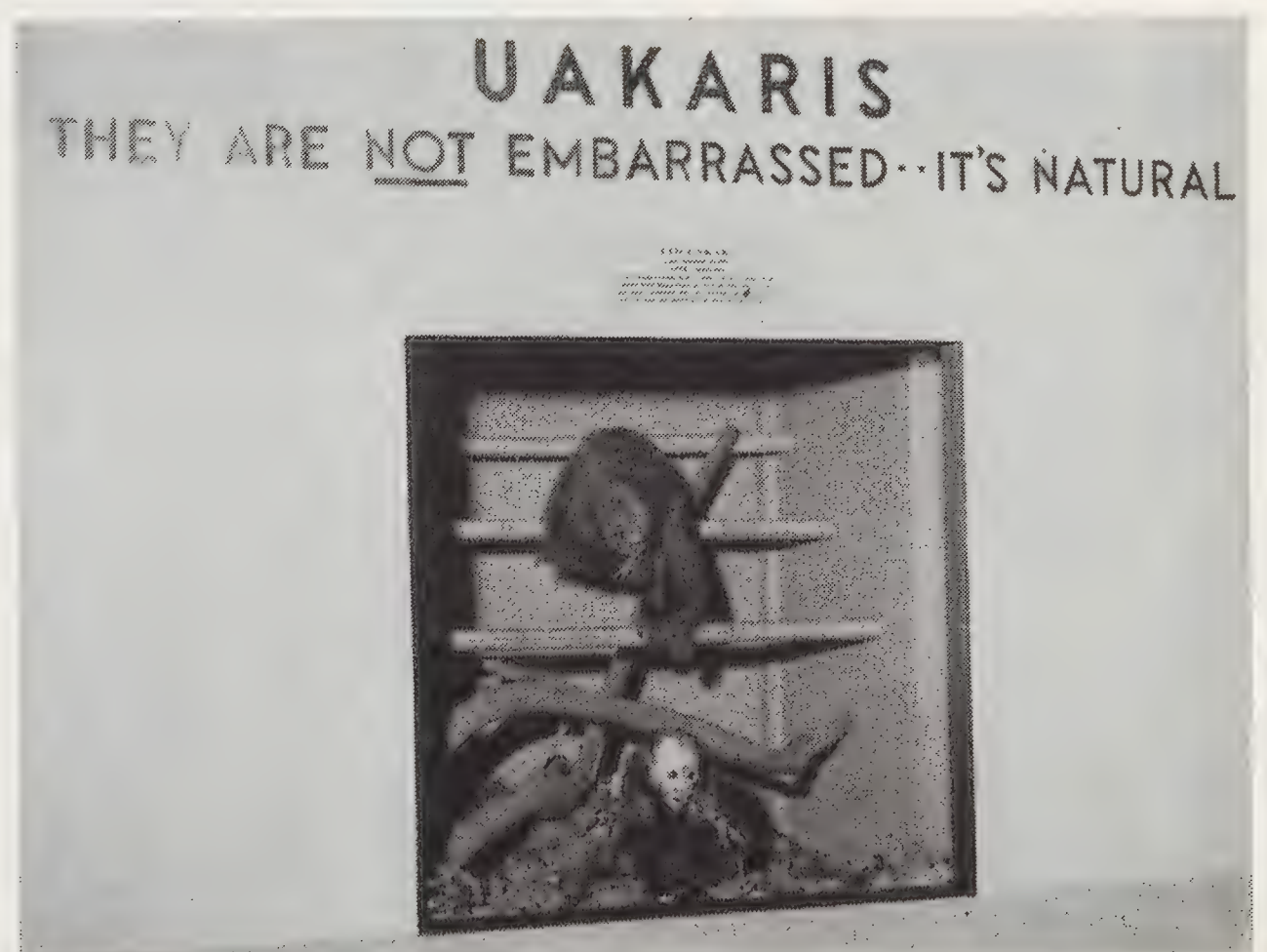
It is no novelty to the Zoo staff to rescue and thaw out small boys who break through the ice on the Bronx River, but a **SOUTH AFRICAN OSTRICH** that goes through the ice presents new and more difficult problems. This Ostrich is at liberty on the African Plains during the winter. Ordinarily the Waterhole in the Plains is dry in wintertime, but in early January a drain became blocked and the waterhole filled to a depth of about 3 feet. Thick ice formed — but not thick enough to bear the weight of the 305-pound Ostrich. It was rescued after it had been immersed for more than an hour, thoroughly chilled and unable to stand. For a few days it lived in a sling until its strength returned.

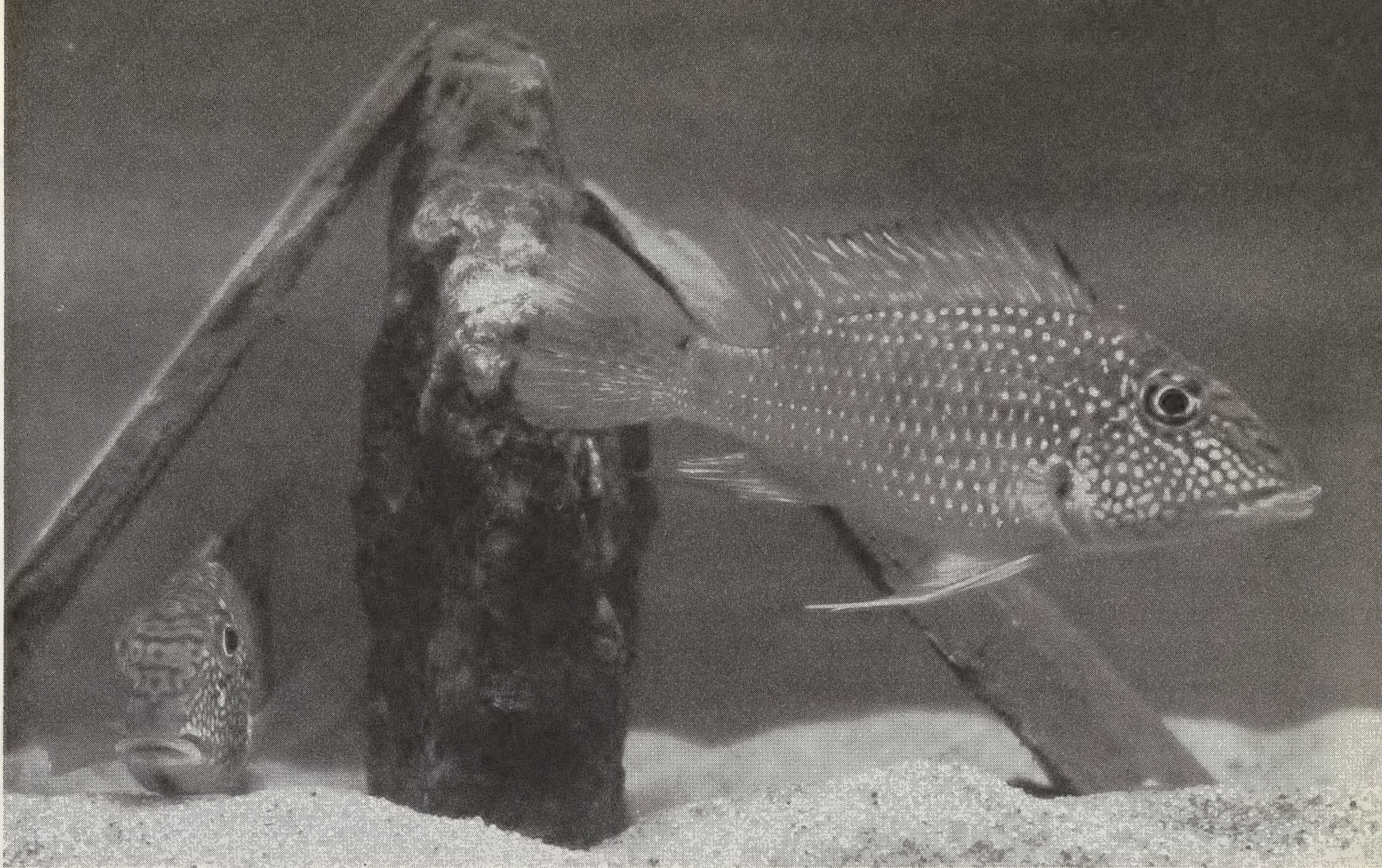


Two thousand Members of the Zoological Society and their guests filled the ballroom of the Waldorf-Astoria on the night of January 6 for the sixty-third annual meeting of the Society. They heard President Osborn report on a successful year in all phases of the Society's interests and a description by Noel Simon, Chairman of the Kenya Wildlife Society, of the plight of African fauna. Motion pictures and a variety of very lively animal exhibits were part of the evening's program.



Above — **BLUE-BREASTED KINGFISHERS** in a miniature orange grove were one of the most striking exhibits at the Members' Meeting. At Right — Grotesque **UAKARIS** were exhibited.





This is the Eartheater, sometimes called the Demon Fish, whose reproductive habits were so confusing until an amateur fish fancier in Brooklyn made detailed studies of his breeding pair.

AN AMATEUR AQUARIST SOLVED IT

By JAMES W. ATZ

A CURATOR in one of today's large public zoos or aquariums seldom gets far from the telephone. Unless he is away on an expedition or collecting trip, he is bombarded with calls not only on official business but from the public at large as well. Anyone seeking information on animals naturally tries the zoo or aquarium sooner or later, and the number and variety of queries that we at the New York Aquarium,

for example, receive by telephone are amazing.

Pet owners are the largest single group of information-seekers. Millions of people keep small fishes or turtles in their homes, and the metropolitan area undoubtedly has more than its proportional share. A good many of these have at one time or another consulted the Aquarium's staff, most frequently by telephone. They may be tyros in search of the most elementary knowledge, or experienced fanciers with unusual problems concerning rare species. Many want an over-the-phone diagnosis of why their turtles have stopped eating or what makes their Guppies or Goldfish sick. Curators are only human, and telephone calls have a way of coming at the most inopportune times, so a certain amount of grumbling is inevitable — especially when one's party has just asked for nothing less than a primer on home aquarium management. But every so often a fancier calls who reverses the usual roles of questioner and informant and gives *us* information. The information may be something we have been trying to get for a long time. Such a telephone call came to me a few years ago, and it eventually enabled me to answer questions that had puzzled me for nearly twenty years.

The call was like many others: a voice somewhat diffidently asking whether or not we could provide information about fish. In this case a pair of the fancier's fish had bred, and he needed advice on their proper care. This, too, was routine — until I learned that the fish was *Geophagus jurupari*, the so-called Demon Fish. At the mention of *Geophagus*, my whole attitude changed so abruptly that my party must have thought me a queer duck indeed. My matter-of-fact, not-quite-bored demeanor at once became charged with excitement, and the ensuing pep talk I gave him probably came as near overwhelming him as instilling in him the enthusiasm that I thought the occasion warranted. For I reiterated how remarkable was his opportunity to make observations on a fish whose behavior was unknown even to professional ichthyologists, admonished him not to lose this chance to make a genuine contribution to scientific knowledge, and offered him — urged upon him — my services in recording the antics of his fish for posterity. He must have been impressed by my eagerness, for since that eventful telephone call, Melvin J. Reid of Brooklyn and I have seen a lot of each other.

At the time, Mr. Reid could not have known that my interest in *Geophagus* went back to 1936 and that, in fact, it was the first kind of fish I had ever studied seriously, the subject of my initial research effort. In 1936 Dr. Charles M. Breder, Jr., was Assistant Director of the Aquarium, which was then located at the Battery. When I showed up as a volunteer worker, less than a month out of college, the first assignment he gave me was to observe a pair of *Geophagus* that had recently bred at the Aquarium without

being observed. It was hoped that I would be able to describe their reproductive habits. It was a worthwhile project and seemed assured of success, but as is so often the case when dealing with living animals, the subjects refused to cooperate. They simply stopped breeding, and that was that.

Although reproductive habits of fishes belonging to the genus *Geophagus* were described a hundred years ago, our knowledge of them has, until recently, remained in a state of disconcerting confusion. These fishes form a distinct if not conspicuous part of the freshwater fauna of northern South America. There are about a dozen known species, all of which seem to show the same type of feeding behavior — from which they get their Latin and one of their popular names, that is, "Earth-eater." A good deal of their time is spent industriously shovelling up mouthfuls of sand or other bottom material and extracting bits of food from it by means of vigorous chewing motions before expelling the stuff through mouth or gill-openings. The trouble with our knowledge of their breeding habits has not been its scarcity but the fact that two very different types of reproductive behavior have been attributed to the same species — and not for just one of the Earth-eaters, but for four or five different species.

At least two dozen accounts of the breeding of various *Geophagus* may be found in magazines devoted to the hobby of keeping fish as pets. All but three of them describe how the male and

At 3½ months, young Earth-eaters do not have the mother-of-pearl markings of the adults but they do exhibit their characteristic profile. These two fish were hatched in Mr. Reid's tank.



female *Geophagus* pair and jointly clean a spot where the eggs are eventually laid and then carefully guarded. The young, too, are watched over, usually by both parents. Such well-developed parental care is typical of the Family Cichlidae to which these fishes belong. In apparent contradiction to this familiar state of affairs, at least a score of *Geophagus* have been caught in the wild with eggs or young inside the mouth, while in four instances the parent was seen to take the young into its mouth in times of danger! Moreover, three amateur aquarists reported similar behavior in their pairs of *Geophagus*, the fish employing its mouth as an incubator as well as a place of rest and refuge for its offspring.

The problem was how to account for two so very different patterns of behavior in a single species. One possible answer was, of course, that the fish in question really belonged to two different species. The fact that no expert in the classification of fishes had studied the group since 1906 made this a distinct possibility. Another explanation might be that the fish orally incubate their eggs and young only when disturbed and that when living within the relatively protected confines of an aquarium, they seldom feel called upon to do so.

All these considerations were running through my mind as I talked with Mr. Reid. I also recalled how I had tried to breed several other *Geophagus*, all to no avail, and how I had tried to get two or three other amateurs, lucky or skilled enough to possess breeding pairs of Eartheaters, to report in detail their fish's behavior — also unsuccessfully. That first day I talked fast and long in my efforts to "sell" Mr. Reid on his golden opportunity. As it turned out, this was but the first of many long telephone conversations between us. Three or four evenings each week Mr. Reid would report on the latest activities of his fish while I would advise him on methods of observation and care. Once or twice I visited his home to see the fish myself, but since we lived at opposite ends of the city, most of our communicating was done over the 'phone.

For more than a year Mr. Reid made careful, detailed observations on his pair of Eartheaters, following them through ten successive spawnings. The final results fully justified his efforts. For the first time, the complete pattern of reproductive behavior of any species of *Geophagus* could

be described — which Mr. Reid did in two articles published in aquarium magazines. Subsequently the two of us analyzed and discussed the subject in great detail. This technical treatment recently appeared in the Society's scientific journal, *Zoologica*.

What did we find out? First of all, at least one species of *Geophagus* has a most peculiar method of reproduction that starts out like that of a non-mouthbreeding species and suddenly switches to fullfledged mouthbreeding. All other orally-incubating fishes are known to pick up their eggs and keep them in the mouth within a few minutes after they are laid. Not so *Geophagus jurupari*; it waits a whole day, in the meantime guarding its eggs, which are laid on a flat stone, in typical non-mouthbreeding fashion. After about 24 hours, either both parents or the female alone commences to pick up the eggs, which are then incubated in the mouth until they hatch and the young are three to four days old. For as long as 37 days the parents care for the brood, allowing the baby fish to swim about and feed, but taking them back into the mouth each night and whenever danger threatens. By this time the youngsters have grown so large that they cannot all fit into their parents' mouths. Soon all ties between parent and offspring are broken.

We now have a reasonable explanation of why at least some fanciers failed to note any mouthbreeding behavior in their Eartheaters. Having seen the fish spawn and commence to care for their eggs as non-mouthbreeding species do, these aquarists assumed that the rest of their behavior would conform to that pattern. With regard to the idea that *Geophagus* behaves differently in nature than in captivity because of the relative security it enjoys in the latter state, Mr. Reid was able to put the matter to the test. He compared the behavior of his pair of Eartheaters in a community tank, where they had to protect their brood from 14 other hungry fishes, with the behavior they showed when kept in an aquarium alone. He found that they orally incubated eggs and young just as carefully and long when kept alone as when beset by other fishes.

There are still many things we would like to know about the Eartheaters, and we must have detailed observations on all the other species. I often wish there were more fanciers with as wet a thumb and as clear an eye as Mr. Reid.



AFRICA--



AND OUR WILDLIFE HERITAGE



THERE IS ONLY ONE PLACE remaining in the entire world where a herd of four to six hundred Elephants can be seen at one time, and that place is the Garamba National Park in the extreme north of the Belgian Congo. But how long these splendid creatures will be allowed to follow time-worn paths is a matter of conjecture. To succeed in maintaining this and other magnificent wilderness areas on the African continent will require an immense effort in the years immediately ahead. Areas like the Umfolozi White Rhino Reserve in the Union of South Africa, the Wankie National Park in Southern Rhodesia, and the internationally renowned Serengeti National Park in northwestern Tanganyika will be watched with concern by conservationists, many of them far removed from the African scene. While the larger parks protect adequate samples of the African landscape and constitute the bulwark of our faunal defense in Africa, small reserve units are needed for the protection of rare or threatened species, such as the Giant Sable of Angola and the Lechwe of Northern Rhodesia. A proper park and reserve program must be based on the fact that habitat can also become extinct. The cultural, scien-

tific and economic values of the great national parks and natural sanctuaries must be more widely disseminated, and wildlife must be recognized as a legitimate and valuable natural resource.

The fauna within the boundaries of the existing national parks and permanent sanctuaries constitutes only half of the over-all wildlife conservation problem in Africa. Equally important is the future security of the wild herds *outside* the effective sanctuaries — the animals that roam over other undeveloped wild lands. As national parks and sanctuaries comprise but a very small portion of the total area of these countries, one can readily appreciate the importance of factors affecting wildlife on the remaining 90 per cent. or more of each country. The comments which follow deal primarily with the future of these animals *outside* the parks.

* * *

MOST Europeans and Americans still imagine Africa teeming with wild herds. Until the Second World War, this was true, at least in large parts of East Africa, but today, unfortunately, these herds are mere memories. Large mammals outside the parks are being eliminated at an ever-increasing pace due to widespread destruction of habitat and intensive poaching. Conservative estimates indicate that well over half of the original

By GEORGE TREICHEL — PART II



Top Left.—These Buffalo are part of a herd of about 250 animals living around Lake Rukwa in southwestern Tanganyika. Contrary to popular belief, the African Buffalo is seldom aggressive and dangerous. When wounded and pursued — that is another matter. Cattle Egrets flock around such a herd and here they may be seen perched on the animals' backs. **Center.**—Bontebok are preserved in the Bredasdorp Bontebok National Park, smallest of the national parks in the Union of South Africa. **Bottom.**—White Rhinoceroses are quite different in temperament from their relative, the Black Rhinoceros. These animals were part of a herd of six in the Umfolozi White Rhinoceros Reserve in Natal. They allowed close approach.

*Illustrations from
Kodachromes by Jeanie Treichel*



wildlife areas have been eliminated, and that well over three-fourths of the animals have been destroyed in the remaining areas. In South Africa the reduction has been almost complete, and the countryside appears much like parts of our own Middle West. In Africa south of the Sahara, only extensive tracts of dense forest retain anything like their original stocks of wildlife, and these were never to be compared with the incredible numbers found on the African savannas and open grasslands. In the latter areas, the ultimate survival of the truly spectacular large animals seems uncertain at best.

At the present time, wild fauna populations outside the parks are generally confined to two categories of land: tsetse fly belts and arid (desert and semi-desert) regions unsuitable for more intensive use by Africans or Europeans. Quite naturally, the choicest blocks of land in each country are producing crops and domestic livestock, as would be true in any other part of the world. In Africa, unlike North America or Eurasia, however, most wild species cannot be maintained in close association with domestic stock, because of disastrous animal diseases. With few exceptions, the activities of wild fauna and the activities of man are not compatible in farming districts. It is a widely accepted fact that over

Two places in Africa where the large and spectacular Gemsbok is most readily seen are the Kalahari Gemsbok National Park on the Union-Bechuanaland border and South West Africa's Etosha Pan.

much of Africa all large animals will be completely eliminated during the next ten to twenty years, except perhaps in fenced national parks and on a few of the marginal lands, i.e., some tsetse and desert areas.

It is entirely fair to state that most wildlife in Africa exists only because the tsetse has prevented intensive stock-raising and agricultural expansion. The various species of tsetse fly require extensive tracts of bush, also prime wildlife habitat. While feeding on blood, they transmit a deadly protozoan from naturally resistant wild animals to domestic cattle which may enter their bush areas. The protozoan causes a fatal cattle disease known as nagana. A few fly species also transmit a protozoan which causes sleeping sickness among human beings; however, this serious disease is now under control in all but the most remote places. To government officials, the tsetse has long been regarded as the foremost deterrent to rural development and progress in tropical Africa — progress which, as in most other parts of the world, relates more to expansion by any means than to

the quality of land utilization. The tsetse has been one of the most effective brakes on that most adaptable of all living creatures — man. Without the fly, much of Africa would be overrun with cattle and over-population would be acute today. In effect, large blocks of land have been deprived of human exploitation and held in trust for wildlife.

The significance of this fly cannot be over-emphasized when studying the history of fauna conservation in tropical Africa. It is also well to remember that many of the important national parks are in tsetse districts and that they would not have been established in the first place if the tsetse had not prevented large-scale stock ranching. In certain parks, tsetse is still their only reason for existence.

It is now known how to eradicate the fly and open these lands to human occupation, but the procedure is too difficult, costly or unpopular to be carried out over extensive parts of Africa at this time. Complete destruction of the bush habitat and all wildlife host species will also eliminate the fly, for then it is deprived of its essential food supply. After the fly vanishes, cattle can be introduced safely. The fly has also been slowly pushed back in some areas by selective bush cutting along with some game shooting, as has been

done in Southern Rhodesia with partial success. Enormous destruction of wildlife has occurred there in the name of fly control. Although no quick and easy method is presently known, the fly problem will most certainly be conquered in the years ahead by industrious laboratory and field scientists. Effective vaccines will permit domestic stock to enter these forbidden regions. And when this happens, the finest remaining faunal and sporting areas will be doomed.

Already most of these remaining faunal areas are being seriously depopulated by poachers using a pernicious assortment of snares, poisons and ancient muzzle-loaders. Poaching (illegal hunting) by natives exists on a scale inconceivable to those who have not been afield in Africa. In earlier times, the Africans killed only enough to meet weekly needs, for self-imposed tribal customs were enforced by the chiefs. In recent years, these and other tribal customs have deteriorated while the population has expanded. Previously the natives hunted only for the pot, but today an increasing number of Africans are engaged in killing on a

Existence of the Red Lechwe is seriously threatened by planned agricultural schemes. These animals were photographed at Lochinvar Ranch, a private reserve on the Kafue River in Northern Rhodesia.



commercial basis. There is now a sizeable illegal traffic in biltong (dried meat), ivory and rhino horn, and poaching for these items is so profitable that it usually exceeds the income that can be earned in any other way by rural Africans. Many of the native reserves are becoming biological deserts; in Basutoland, virtually everything has been eliminated, and the people have been reduced to using cow dung for fuel. Protein-hungry tribesmen point to a precarious future for the remaining stocks of wild animals, especially on government lands adjacent to native reserves. In some places, crops are planted to *attract* Buffalo and other species in order that they may be taken for meat. The situation will become more acute as the native population doubles itself in the next twenty to thirty years. The European in Africa has prevented tribal warfare and has introduced widespread public health measures, and the result is an exploding population.

When discussing fauna impoverishment, a third factor in addition to poaching and habitat destruction is often mentioned. What part have the big game hunters played? Big game hunting gets a good deal of publicity, and many outside of Africa feel that this group alone has eliminated much of what once existed in areas other than national parks. In reality, all sport hunters combined take but a fraction of the total game destroyed by poachers. In Tanganyika, for example, more animals are destroyed by poachers in one week than are taken by safaris during an entire year. Properly regulated hunting is directed toward harvesting an annual surplus of animals, not the capital breeding stock. The future will bring even more vigorously controlled shooting, and species like Lion and Rhino will have to be strictly rationed. Big game hunting in Africa has a distinct value, for it permits outsiders to become acquainted with remote regions (patrolling them at the same time) and arouses much positive interest in wildlife conservation problems. In addition, it has an important economic value in some countries. It is well to remember that a large percentage of those working in wildlife conservation today started as enthusiastic hunters. The trend, however, is toward an increasing number of safaris devoted to photography and the viewing and enjoyment of wildlife in its natural habitat.

Until very recently, fauna conservation in



Springbok are not uncommon in the wilder parts of southern Africa. These graceful antelopes are great jumpers — hence their name.

these African countries has been poorly organized and even today most game departments are fighting nothing more than a rear guard action. They have regulated big game hunting, but they have seldom been able to take effective and decisive action against poaching. Game departments operate at the Warden level only, and they are insufficiently staffed and financed. Often a single Warden has the responsibility for patrolling an area half the size of New York State — obviously an impossible assignment. Consequently, much poaching is beyond the law. There are many competent men in these departments and a few have enthusiastically adopted the modern wildlife management concepts which have evolved in Europe and America. They view wildlife as a valuable natural resource and would like to initiate forceful programs of conservation education and basic research, but trying to win the cooperation of government is the major hurdle. Much of their time is devoted to the battle against uninformed criticism, a good deal of it from apathetic government officers in other departments. Game Departments are, by and large, unpopular with high government officials, for they try to save what other departments are attempting to eliminate and replace. In Northern Rhodesia the situation has been acute.

What is the official attitude of the governments toward wildlife conservation, and where does fauna fit into the future scheme of things? This can be summarized by stating that the governments insist, quite logically, that the basic econ-

omy and development of each country must be given primary consideration. Everything else, including wildlife, is strictly secondary. This is not unreasonable, but secondary considerations are occasionally not even given secondary consideration. The national parks usually receive some attention, but wildlife as a valuable renewable resource is ignored. Many of the responsible government authorities are apathetic because they are unaware of the part wildlife could play on tsetse and arid lands unsuited for domestic stock production. Instead, the general view prevails that wildlife is something to be eliminated and replaced by domestic stock wherever possible. Such was the attitude in our own country during frontier days. We ourselves have been rather



The magnificent Sable Antelope — a sought-after trophy of big game hunters — is maintaining its numbers but only in reservation.

inept at presenting wildlife and wild country as economic resources to be intelligently managed. And where there is little understanding of our point of view, there can be little cooperation.

In the decades ahead, it will be essential for these African governments to provide for an enormous expansion of the domestic animal industry to meet the protein requirements of an increasing population. Pressures will make it necessary to open most of the remaining tsetse areas to cattle, and some of these areas will undoubtedly make outstanding ranches. But extreme caution should be exercised in opening these and other arid areas. Most extensive semi-desert tracts in Africa are unsuited to domestic stock production on a continuing basis. All across Africa, the pattern of

land destruction has been similar: over-stocking, then over-grazing and deforestation, next soil erosion and declining fertility, and ultimately rural devastation. Much of Africa is going the unhappy way of Somaliland and portions of the Masai Land Unit, where the entire environmental base is being undermined by uncontrolled numbers of cattle, sheep and goats. These animals bring the desert with them. The irony is that much of the livestock is maintained not as a food resource, but as a symbol of wealth and social standing in certain tribes. It is true that some of these areas may have relatively low human densities, but nevertheless, they have exceedingly high livestock densities which result in serious over-use of land. Therefore, in much of Africa, lightly populated areas are already fully occupied.

Since some tsetse and arid areas are free of domestic herds, there will soon be a choice between eliminating the existing wild animals and replacing them with cattle or maintaining and utilizing the present wildlife resource. Some ecologists believe that these areas are best suited to the retention of wildlife, and that wildlife protein production is the highest long-term use to which many of these marginal lands can be devoted. It is only fair to report that when wild fauna is eliminated and livestock is introduced in its place, the immediate meat and money yields are greater for the first few years. But domestic animals invariably end up by destroying the entire habitat, for man as well as beast. On the other hand, scientifically-managed wildlife populations can offer



Very large flocks of Ostriches, sometimes 100 or more, are frequently observed in the Etosha Pan Reserve in northern South West Africa.

renewable protein production in areas where domestic livestock production has proved to be difficult and detrimental, for wildlife is able to utilize the vegetation without destroying it. At present, the one resource that is well adapted to the marginal environment is being eliminated. If native chiefs and leaders could be convinced that wildlife can be preserved as future meat supply with definite economic value, a suitable plan may be formulated. Some tribes would not want the meat, but they would all welcome the money derived from meat sales. At present, the natives insist that tsetse denies them additional cattle and wealth; this new approach offers them an economic incentive for keeping wildlife.

Game will not be maintained by natives for sentimental reasons. Some enthusiasts outside of Africa will undoubtedly be displeased to have the meat and commercial factors introduced when considering these magnificent African animals. Yet such practical considerations offer our final opportunity to maintain any sizeable wildlife population outside the national parks. Game stocks in most places will only be preserved through management. This has been true of certain wild populations in western Europe, Canada and the United States. Last year, for example, more than 700,000 White-tail Deer were harvested out of a total population of four and a half million in the United States.

What is essential in Africa is the application of scientific knowledge to land use problems. Modern concepts of wildlife management will have to be modified to meet unique African situations. Manipulation of fire and water will be essential. But our greatest need is to acquire basic knowledge. There is a real sense of urgency concerning the need for organized research relating to the African fauna, for the biology of even the commonest species is very imperfectly known. Hundreds of books have been written about these animals but they contain little of value to the research student. There is no precise data about feeding and breeding habits, population dynamics or migrations; no ecological studies in depth. The most serious deficiencies are wildlife census figures, without which no scientific or management program can be carried out effectively. A beginning has recently been made by several Fulbright teams, but field investigations need to be organ-

ized on a more permanent basis. When considering the total continental wildlife situation, one realizes that the spectacular plains fauna of East Africa deserves the highest priority. Decisive action must be taken now to perpetuate this unrivalled assemblage, the finest that remains.

The problem in Africa then, is two-fold. Maintaining the national parks and permanent sanctuaries as a unique and precious international cultural asset is the most inspirational phase. Managing wildlife populations for protein production outside of these parks is the practical phase. Without economic incentives, both programs may fail as the native population doubles and development accelerates. There can be no expression of optimism unless conservation education of African leaders is attempted. The situation is complicated by the fact that wildlife reminds some African leaders of the primitive past, to be forgotten or eliminated if possible. Still others are tempted to reject many of the things connected with Colonialism, including national parks and nature protection. Eight out of ten Africans still lead simple lives in the bush. More children, more cattle and more land are their only desires. The task ahead is prodigious, but without African participation, the entire effort to preserve the superb fauna of Africa will collapse in the relatively near future. If present trends continue, a few of the national parks may be retained, but little else.

North America has been instrumental in formulating and developing the concept of maintaining wild land as a recognized and legitimate resource. Today our immense conservation movement is in a position, if properly motivated, to accept the challenge to assist some other parts of the world as well. We have examined the need to demonstrate international interest in the wildlife resources of Africa. The great variety and beauty of the large mammals and the extraordinarily impressive avifauna are worthy of greater attention on our part. But the herds are vanishing and much of the grandeur of the African bush passes with them.

The next report in ANIMAL KINGDOM will focus on current wildlife trends, attitudes and problems in Kenya.

News from the Conservation Foundation

Economic Evaluation of Forest Insect Control Program

A review is now under way of the pros and cons of major forest-praying programs such as those against the gypsy moth and the spruce budworm. Several of these programs have become controversial recently, particularly as regards effects of chemicals on wildlife populations. Many of the effects of spraying, or of *not* spraying, cannot be measured entirely in monetary terms. A reasonable policy on pest insect control must give consideration to all aspects involved, including long-term effects on the entire forest environment.

The aim of the review is to develop criteria for such control programs so that proposed spraying can be broadly evaluated. The analysis, to be furnished by next summer, is being made by Prof. Albert W. Worrell of the Yale Forestry School, who is a forest economist with extensive background in problems of forest land use.

Alaskan Conservation Research Center

Richard A. Cooley arrived in Juneau, Alaska, in early January to establish a Resources Research Center under a grant from the Conservation Foundation. The Center will be primarily concerned with evaluating research projects, in cooperation with Alaskan authorities, to further the optimum utilization of natural resources in this great new state.

Arden House Meeting

Dr. Osborn addressed the Conference on Nutrition sponsored by the New York Academy of Medicine at Arden House on December 15. The title of his address was "Nutrition and Population Pressures."

He reviewed the fundamental relationship between food supply and population, and stated that "We are witnessing a fantastic evolution in human society and one that if long continued will prove intolerable for social and political welfare in general and for nutritional standards in particular."

Spruce Budworm Spraying

It was reported in this column in July-August, 1958, that we were conducting a research program on the effects of DDT sprayed on 302,000 acres of spruce-fir forest in Maine. Analysis of field data from this spraying shows a successful reduction of 96% in budworm populations without decreasing the parasites which are budworm enemies.

This carefully coordinated program was directed by Commissioner A. D. Nutting, now Director of the School of Forestry of the University of Maine, and Robley W. Nash, State Entomologist, and with technical operational assistance by the U. S. Forest Service and Forest Protection, Ltd., of New Brunswick.

Associated studies were carried out to determine effects on wildlife in the area. Stream insect life, the food supply of fish, was substantially reduced after spraying, but was increasing again by August. We are supporting a continuing study of stream insects to determine the date of return to natural populations, as well as a study to measure the effect, if any, of DDT spraying on seeds and seedlings of spruce and fir.

Colorado College Center

On December 16 an initial payment was made to Colorado College on a three-year grant for the establishment of "The Instructional Materials Center of The Conservation Foundation at Colorado College." The Center, which is under the directorship of Dr. Robert Z. Brown, will be primarily concerned with water resources.

This is the second educational center which the Conservation Foundation plans to create at American Colleges in geographically widely-separated areas of the country.

The first of these, "The Conservation Foundation's Curriculum Center at the San Fernando Valley State College" in California, was established last October and is operating under the direction of Prof. Elizabeth Hone.

Each center concentrates on a specialized phase of resource-use which is of particular concern to

the region, and, with its board of advisors, co-operates closely with the local school system in which the teaching materials and devices produced or collected by the Center are made available.

The college will endeavor to secure matching funds to be added to those granted by our organization. Our hope is that over a period of years these Centers will become financially self-sufficient.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Gulls Foiled and Annie Fathers Two Chicks

Annie, the mis-named male Black-foot Penguin which the Zoological Park inherited from the old Aquarium at the Battery, and his equally mis-named mate, Barney, hatched out two chicks on December 22 and 23 in the Penguin Pool enclosure. Their success was certainly in part a result of the "gull baffle" installed earlier in the winter.

For years Herring Gulls have been in the habit of hanging around the Penguin Pool to steal fish at feeding time, and often they make thieving attacks on the nests of the penguins in the series of shallow rock caves along the north end of the enclosure. Now we have hung wooden baffles from the top of the entrance to each cave and the gulls can no longer swoop in, steal an egg and fly out.

Red Shoveler Ducks—With a Story Behind Them

The Zoological Park's weekly accession sheet that lists newly arrived mammals, birds and reptiles contains, for the week before Christmas, a brief note that a pair of Red Shoveler Ducks (*Anas platalea*) had been received from the Severn Wildfowl Trust in England. There is a story behind that routine book-keeping entry.

In 1948 General Curator Emeritus Crandall, then General Curator of the Zoo, looked over a collection of about a hundred ducks brought to New York by an animal dealer. Out of them he chose one — a rare Red Shoveler duck from southern Brazil and Argentina. It was the first time the bird had ever been in our collection, and we knew of no other elsewhere.

In the course of the next two years Peter Scott of the Severn Wildfowl Trust made a couple of visits to the Bronx Zoo and both times mentioned pointedly that he knew where he could get a Red Shoveler drake. It appeared that before the war, Jean Delacour had a Red Shoveler in his collection at Cleres, in France. The Germans dispersed much of the collection (what part they did not kill and eat) and the drake went to the Jardin des Plantes in Paris.

Mr. Crandall finally gave in and told Mr. Scott he could have our duck, if he could get the drake from Paris, but that we expected to receive a pair of the offspring.

They arrived on December 20. As far as we know, the only Red Shovelers on exhibition anywhere are the product of our duck and the Delacour drake.

Zoo Begins Its Sixtieth Year With Birth of a Nyala

The Zoological Park will be sixty years old on November 8 of this year and well before that time we expect to be far advanced in plans for the building of a new Aquatic Bird House to replace the present building — the first one completed in the Zoo — which was the scene of the opening ceremonies in 1899. Details of the innovations planned for the building will be announced later in the year.

To our Nyala antelope herd we owe the first birth of the new year, a youngster born on January 3. The Nyalas also produced the last baby of 1958, on December 31.

The Zoological Park had a total attendance of 1,948,945 in 1958, a decline below the two million mark for the first time in several years. The drop was easily attributable to the rainy weather

which also caused a drop in Children's Zoo attendance to 315,668. On 23 days between April 5 and November 11 the Children's Zoo was closed because of rain and on more than 20 other days it was able to be open only an hour or two. Total attendance in the Children's Zoo since 1941 is now 5,306,270.

Membership in the Zoological Society showed an excellent gain of 141 in 1958, to a total of 3,601.

End-of-the-year census reports of the collection were not available as *ANIMAL KINGDOM* went to press, but it appears that the collection will again total more than 1,000 species and subspecies.

Lion Understudies

Five baby Lions, all males, have been acquired from other zoological parks in the past month and are currently resident in the Animal Nursery. All are "understudies" to the five ten-year-old Lions that have been exhibited on the African Plains since 1949. The older Lions, with advancing years, have become lazy, and the newcomers will enliven the scene greatly when they take over Lion Island in the spring of 1960.

IN BRIEF

A Valuable Book. In May of 1957 the Zoological Society published a 613-page book, "The Physiology of the Pituitary Gland of Fishes," by Dr. Grace E. Pickford of Yale University and Associate Curator Atz of the Aquarium. To date more than 600 copies of this highly specialized monograph have been sold, about a fourth of them to research workers in other countries.

Easy-to-Get Rarities. Steve Spencook, the Head Keeper of Reptiles, has a habit of glancing into pet shop windows whenever he passes one — just on the chance that he might see something interesting. In December, in a pet shop in downtown Manhattan, he saw some baby turtles that he did not recognize. The shop was quite willing to trade two of them for several of our excess local turtles, and Spencook brought his bargains back to the Zoo. They turned out to be Reeves' Turtles, *Chinemys reevesii*, from western Asia, a species we had not exhibited for 25 years.

Genetics Lab Is Growing. The Society's Genetics Laboratory in the American Museum of Natural History has just undergone extensive reconstruction and now is able to maintain 629 aquaria.

First Baby Hippo. A 53-pound baby was born to our young pair of Nile Hippopotamuses, Peter and Phoebe, on the night of December 23 but it died the following morning. This was Phoebe's first baby and we hope for more successful future births.

Porcupines. Two Canada Porcupines, one normal color and one an albino, are now on exhibition in the outside compartments on the east side of the Small Mammal House.

Talks at A.A.A.S. Drs. Nigrelli and Gordon of the Aquarium staff presented papers at the winter meetings of the American Association for the Advancement of Science in Washington. Dr. Nigrelli's paper concerned the effects of Holothurin, the toxic substance he discovered in a West Indian sea cucumber, on the blood-forming organs of the frog, while Dr. Gordon's dealt with two similar kinds of pigment cells found in fishes in the Genetics Laboratory, one of which leads to melanoma when present in hybrids, while the other does not.

Death of a Platypus. Paul, the male Platypus in the trio that came to us from Australia in June, died on December 20 after a long and gradual decline for which no specific cause can be found. Pamela, the surviving female, has been erratic in her feeding but appears to be in good health otherwise.

Shells to Aquarium. A very fine collection of seashells, valued at more than \$8,000, has been presented to the Aquarium by Mrs. Jerome N. Schweitzer.

PUBLICATIONS OF INTEREST

THE AUDUBON BOOK OF TRUE NATURE STORIES. Selected and edited by John K. Terres. Illustrations by Walter W. Ferguson. 294 pp. Thomas Y. Crowell Co., New York, 1958. \$5.00.

Forty-eight articles, mostly about wild pets, reprinted from the *Audubon Magazine*. The authors range from well-known nature writers to "unknowns," the pets from chickadees to cougars. The stories are described as "some of the best-loved" of those that have appeared in the magazine, and the genuine ring of personal and loving experience in the best of them makes the descrip-

tion seem likely. Mr. Terres has chosen wisely for many tastes, and the Ferguson illustrations are superb. — W. Br.

STUDIES ON THE STRUCTURE AND DEVELOPMENT OF VERTEBRATES. By Edwin S. Goodrich. Vol. I: Chapters 1-8; Vol. II: Chapters 9-14. 837 pp., more than 700 illus. Dover Publications, Inc., New York, 1958. Two volumes: \$5.00.

Unabridged reprints, in two volumes (hard and soft anatomy, respectively), of the original one-volume work, a classic that has long been unobtainable even in second-hand bookstores. Vol. I contains the obituary of Goodrich that appeared in the *Quarterly Journal of Microscopical Science*.

THE GENETICAL THEORY OF NATURAL SELECTION. By Ronald A. Fisher. 291 pp., 2 pl. Dover Publications, Inc., New York, 1958. \$1.85.

Revised by the author, a second edition of the work first published in 1929. Part of the Dover series of reprints of scarce or unobtainable books of great importance in biology.

THE LIVING FOREST. By Jack McCormick. Drawings by Matthew Kalmenoff; photographs. 127 pp. Harper & Bros., 1959. \$3.95.

Last May the American Museum of Natural History opened its Hall of North American Forests, a spectacle — there is no other word for it — that must open the eyes of every visitor to the grandeur and the complexity and

the mechanics of the forest. Dr. McCormick's book "derives" from the Museum exhibit but is not a guide to it; it will sharpen anyone's interest in forests anywhere. Many excellent photographs, and vivid drawings by Matthew Kalmenoff. — W. Br.

A STUDY OF BLACKBIRDS. By D. W. Snow. 192 pp., 23 illustrations. George Allen and Unwin, London, 1958.

"A Study of Blackbirds" is a first book by the Resident Naturalist at the Department of Tropical Research Station at Simla, Trinidad. It might be called a popular monograph, dealing with every phase of life and behavior of the English Blackbird as observed at Oxford. It is interesting and valuable, and an excellent example of what might be done with our Robin or other American birds. One striking fact deals with the use of the sense of hearing in finding food.

"Blackbirds habitually rob smaller birds of their food. . . . In most cases the blackbird reacts to the sight of another bird holding food in its beak or extracting something from the ground; but in the case of song thrushes with snails Morris found that, if the thrush is out of sight, the blackbird reacts to the cessation of the sound of hammering, the sign that the snail is in a state in which it can be dealt with by the blackbird." — W. Beebe.

New Members of the New York Zoological Society (Between November 1 and December 31, 1958)

Life

Mrs. Elizabeth S. Habif

Supporting

Pedro N. S. Abreu

Carroll K. Bassett

Mrs. Irving Berlin

Mrs. Randolph P. Compton

Elmer C. Otto

Miss Amelia Peabody

John Pierrepont

Mrs. R. Stuyvesant Pierrepont

Mrs. Walter S. Poor

Mrs. S. B. Randolph

William D. Scholle

Contributing

Herbert Baltuch

Dr. E. Lovell Becker

Gilbert G. Browne

W. G. Buckner

Mrs. James W. Correll

Jack Cottin

Dr. J. Richard Czajkowski

Mrs. D. Crena de Jongh

Dr. M. Joseph de Marinis

Fred Ferber

J. Perry Fitzhugh

Mrs. Langdon Geer

S. Delvalle Goldsmith

Oliver R. Grace

Mrs. J. Horton Ijams

Kendall Landis

Mrs. Ellis W. Leavenworth

William Leslie, Jr.

M. William Levy

James John McCaffrey

Mrs. Frank R. Oastler

Mrs. Carleton H. Palmer

Charles Plohn

Mrs. Salvador Ros

Mrs. William B. Schiller

Mrs. Charles E. Scribner

Mrs. Henry T. Shelton

Mrs. E. G. Stuart

Mrs. Jane Belo Tannenbaum

Mrs. M. Brown Trimble

Weston Vernon, Jr.

Harry Viosca

Miss Ruth Way

Dr. Mordecai Zucker

Annual

Mrs. Carter S. Bacon

George Payne Bent, II

C. W. Busk

Junius B. Calitri

Paul G. Claudato

George E. Coonan

John J. Cooney

Edward L. Crabbe

Mrs. Palmer Dixon

Mrs. Rose Dobkin

Henry F. Doering

George E. Dyke

Mrs. Jackson A. Dykman

Miss Susan Edmonson

F. R. Eberhard

Norman A. Fately

Mrs. H. Fischbacher

Sterling D. Foote

Mrs. Louise Galloway

Mrs. W. French Githens

Mrs. Carl Gram, Jr.

Miss Alma B. Helbing

Miss Olive Huber

Peter Iselin

Mrs. Howard Jaffe

Eugene Jamin

William R. Joyce, Sr.

Mrs. Phillip Kaplan

Walter A. Kuenzli

Mrs. Walter Learned

Arthur Leibowitz

Otto Marx

Mrs. Manton B. Metcalf, III

Mrs. Hubert McDonnell, Jr.

Miss Betty Mitchell

W. P. Moor

Mrs. Hoffman Nickerson

Robert C. Nordhausen

Larry Orenstein

Miss Isabel M. Peters

Frederick M. Peyser

Michael Pike

Dr. John L. Pool

Fred Rittierodt

Miss Wendy Robinault

Bernard Rous

Dr. Oscar Schwartz

Robert E. Scofield

Mrs. Geddes Smith

Mrs. Lore Steinitz

Robert E. Strawbridge, Jr.

Benjamin H. Trask

Mrs. John B. Trevor

M. Ulmann

Dr. Jesse Werner

Miss Nancy R. West

That Sixty-third Annual Meeting

The recent January Members' meeting in the Waldorf-Astoria was as pleasant a gathering as the most senior Member can remember.

Some of the ingredients that made it a success were:

- Exuberant animal exhibits — birds — an Alligator Snapping Turtle — Red-faced Uakaris — and fish and more fish.
- Striking motion pictures — contributed by Staff Members Dunton and Ray, Benefactor Saul Blickman, Naturalist David Fleay and Life Member Bayard Read.
- An informative report on the state of the Society by President Fairfield Osborn and an impassioned plea for African Wildlife by Noel Simon.

But the most important ingredient binding everything together — as distinctive and clear as the soft woodwind note of the Black-necked Swan on the Zoo's Heart Lake — was the warm enthusiasm and sympathy of the 2,000 Members and Friends at the meeting. They made the austere ballroom throb.

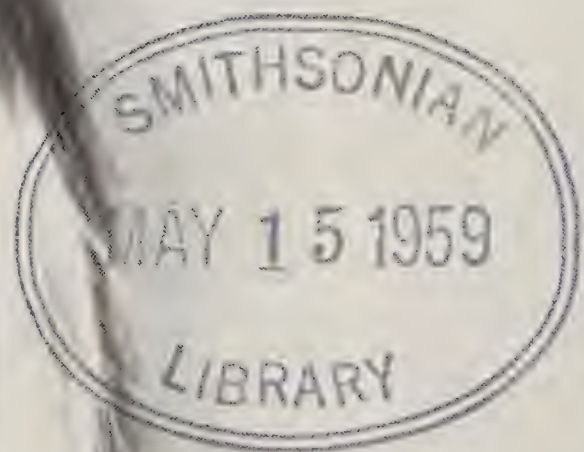
GORDON CUYLER
Membership Chairman



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John C. Gibbs
Roger D. Hale
George Wall Merck
Samuel H. Ordway, Jr.
Hugh J. Ross

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Aquarium—

On the March

AS REPORTED in an article in this issue, the new Aquarium is "on the march" and lively plans are now being carried out for its extension and improvement.

Few worthwhile goals are easily reached. Our institution was fully aware of this when it undertook the responsibility of planning and managing the new Aquarium. We knew we were facing many operational difficulties, including the collecting and acclimatizing of many different kinds of marine exhibits, problems such as obtaining good ocean and fresh water supply, temperature control, chemical content of water, and a host of other technical matters. Practically all of these have now been overcome although a system to obtain really satisfactory ocean water of proper clarity has still to be established.

Quite apart from such problems, we were given an additional challenge by the City government, namely, that the Aquarium should be self-supporting; in other words, instead of having its operating costs provided from the public treasury that it should carry itself from admission charges. This plan marks a new step in the administration of quasi-public institutions in the City — the museums, the zoos and the botanical gardens — an experiment which is undoubtedly well worth trying.

The Aquarium is steadily growing in public interest and it is our hope and expectation that the current program of development will go far to establish it firmly as one of the outstanding attractions of New York.

Fairfield Osborn

DOUBLE COVER

Staff Photographer Dunton turned in two photographs of the Uele Colobus Monkey and her baby, suggesting that one of them might make a cover for ANIMAL KINGDOM. But how to choose between them? The staff debated . . . and debated . . . and decided to use them both, as a front cover *and* a back cover. Incidentally, since these photographs were made the baby which was all white at birth has become progressively darker and now is almost as dark as its mother except for the white cape on its back.



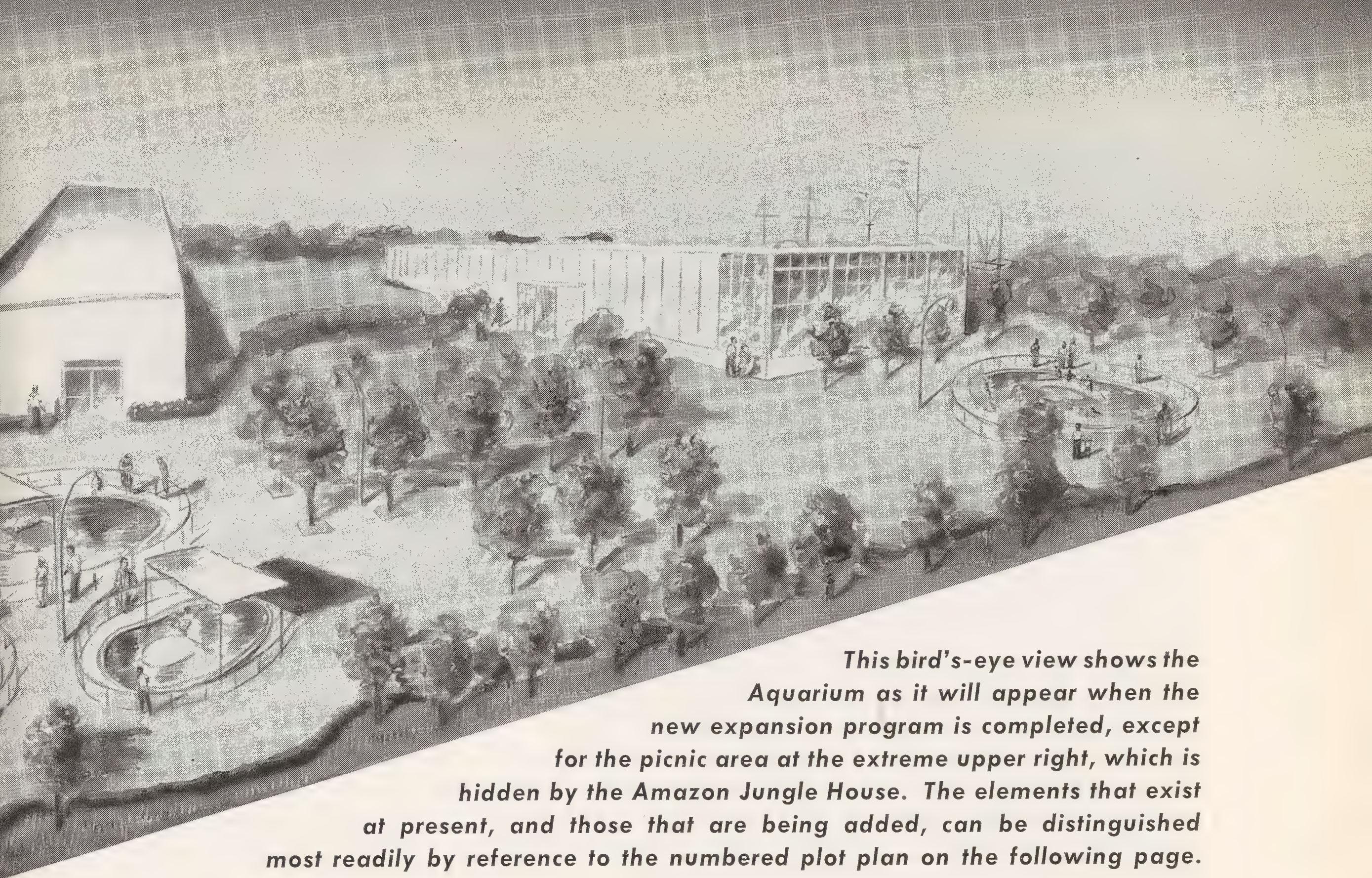
THE AQUARIUM IS GROWING

By Christopher W. Coates

THE YEAR 1959 will be an important one for the New York Aquarium. Early this spring construction begins on a \$381,000 program to expand our exhibits and improve our facilities, and early this fall we expect to start work on the installation of a new ocean water filtration system at an estimated cost of \$300,000. Visitors will then enjoy four new major displays

and many smaller ones as well — all with greater ease and convenience and with increased services to make their stay an even more pleasurable one.

The Aquarium building itself is to be enlarged by the addition of a wing to the east. This will house a Hall of Local Marine Life and a motion picture theatre. New York is a maritime city, and its citizens, as well as tourists from inland places,

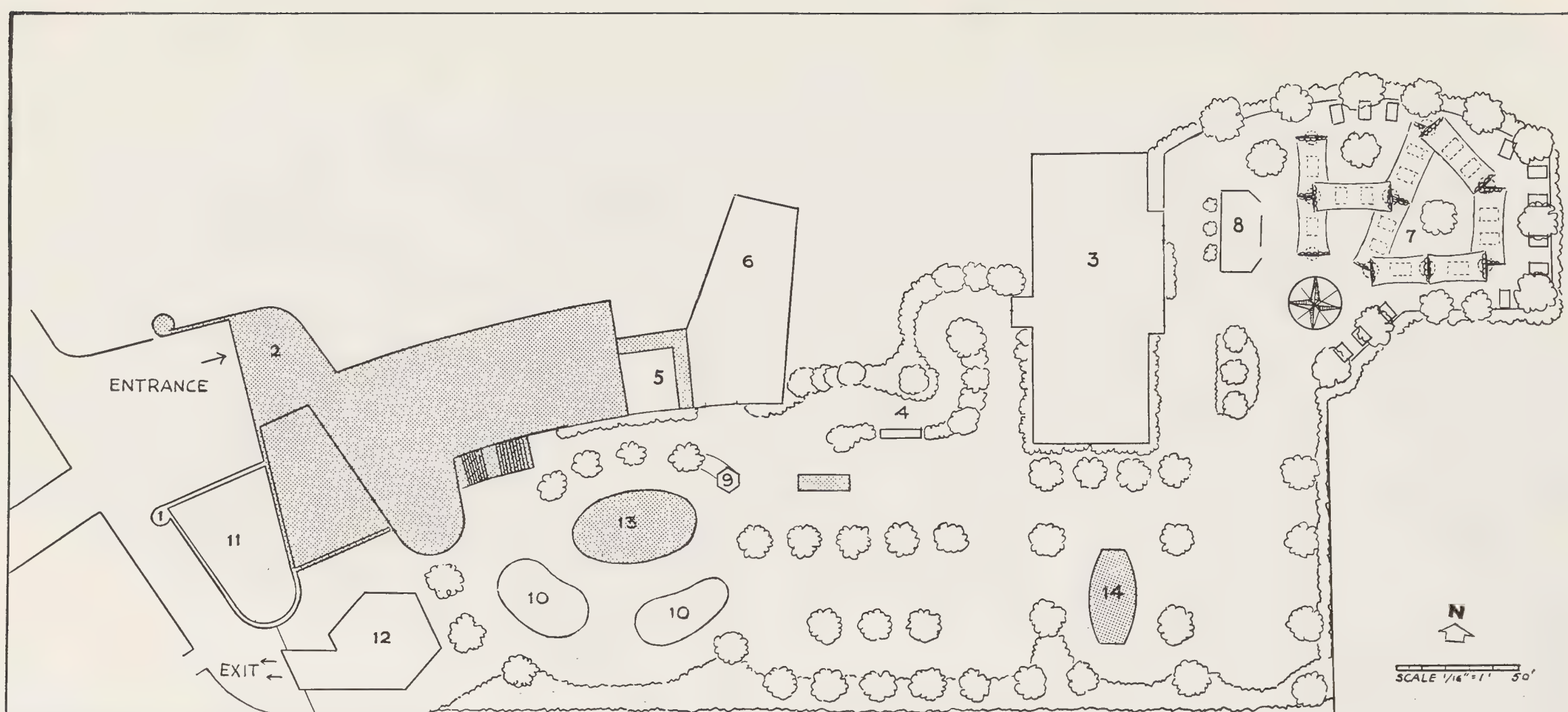


This bird's-eye view shows the Aquarium as it will appear when the new expansion program is completed, except for the picnic area at the extreme upper right, which is hidden by the Amazon Jungle House. The elements that exist at present, and those that are being added, can be distinguished most readily by reference to the numbered plot plan on the following page.

are keenly aware of its docks and ships and island geography. The nearly one hundred species of fishes — to say nothing of the hordes of other marine creatures — that inhabit New York Harbor and its environs form an essential part of the picture. We feel that it is really our *duty* to exhibit a representative sample of them. Local salt water fishermen, for example, will make this new hall a Mecca, for they would almost rather see their favorite sports fish swimming about in a tank than on the end of their line! Although finny rarities from the other side of the globe may receive but a moment's glance from these sportsmen, an unusual species from nearby waters excites no end of interest. Nor can we forget our school children, Boy Scouts and the like, all of whom want to know the local fauna.

Having motion pictures as a regular part of our display presents such exciting possibilities that we must confess we can hardly see the end of them. In any event, we know that the show will be included in the price of admission and that *one* of its subjects will be the behind-the-scenes activities at the Aquarium — collecting specimens, for example. The opportunity to combine education with entertainment is nothing short of magnificent.

Up to the present we have had to neglect the fishes and other animals inhabiting fresh water. As marvelous as many of them are, we felt that the various forms of sea life had to be given precedence, since we had only a limited amount of space. Now we shall have our first full-fledged freshwater exhibit, and it is fitting that it should be devoted to the life of the Amazon, the largest of all rivers and containing by far the richest fluviatile fauna in the world — more than a thousand species of fishes. We intend to show some of the most notable ones, such as the giant Pirarucu and Pirahyba, the savage Piranha and the weird Aruana. They will be exhibited in tanks that simulate a section of an Amazonian tributary, under a realistic jungle bank of live plants of many sorts, with bright-colored birds such as macaws, and other appropriate animals — sloths, perhaps. Habitat groups of this type have been very successful in both European and American zoos, but none has ever been tried on the scale we are planning. Our living habitat group will occupy somewhat less than half of an Amazon Jungle House, a building 48 by 120 feet, part of which will be constructed like a greenhouse. The remainder will contain a tremendous tank 40 feet long and 16 feet wide, inhabited by



THE EXISTING AQUARIUM (SHADED AREAS) AND THE EXPANDED EXHIBITS

- | | | |
|-------------------------------------|------------------------------------|---|
| 1. <i>Bathysphere</i> | 6. <i>Motion Picture Theatre</i> | 11. <i>Filter System for Oceanic Tank</i> |
| 2. <i>Main Entrance</i> | 7. <i>Picnic Area</i> | 12. <i>New Souvenir Building</i> |
| 3. <i>Amazon Jungle House</i> | 8. <i>Food-vending Machines</i> | 13. <i>Existing Seal Pool</i> |
| 4. <i>Outdoors Tank</i> | 9. <i>Portable Seal Food Stand</i> | 14. <i>Existing Penguin Pool</i> |
| 5. <i>Hall of Local Marine Life</i> | 10. <i>Additional Seal Pools</i> | |

a colony of sharks, and a spectacular demonstration of the electrical powers of the Electric Eel. Our present Electric Eel show, which we put on once every hour, has proved so popular that we are forced to move it into more commodious quarters. This will also give us an opportunity to expand the show, making it more amusing as well as instructive.

The fourth of our new major displays consists of two outdoor seal pools. These will be combined with our single existing seal pool to form an exhibit whose flexibility will make it possible to more than triple our present collection of pinnipeds. We have always featured our seals, sealions and walruses; the additional pools insure pre-eminence in this field.

One of the main difficulties with our present building is that it soon becomes congested whenever crowds of any size come to the Aquarium. The new displays are all designed to relieve this congestion. To improve the flow of traffic still further, our present lobby, through which visitors may now both enter and leave, is being radically changed. In the future, visitors will only enter the Aquarium at this point, and they will leave at another location not far away but completely

separated from our front doors. The souvenir counter will be relocated, in an attractive steel-and-glass building near the new exit.

Other improved facilities for visitors include a spacious picnic area, serviced by a small houseful of vending machines, a public address system to announce feeding times, demonstrations and the like, and an installation to sell small fish to be fed to the seals and sealions.

Finally, a new, specially-designed water system is to be put into operation. This will provide us with another much-needed source of salt water and will enable us to clarify the water in our Oceanic Tank.

The cost of this water system is being shared equally by New York City and the Zoological Society. All the remaining exhibits and facilities are being built entirely with Society funds this year. These important changes and additions are based on our own operating experience, especially during the last two years at Coney Island, combined with the expert advice and planning of the Marco Engineering Company of Los Angeles, Goldstone & Dearborn of New York, Thomas M. Riddick of New York and Ebaugh & Goethe, Inc., of Gainesville, Florida.



A VISIT TO OUR FIRST TAKIN

BY RICHARD D. ESTES

THROUGH the good offices of Oliver M. B. Milton and Richard D. Estes, now making a wildlife survey in Burma, the New York Zoological Society is making arrangements to receive the first Takin (*Budorcas taxicolor*) ever seen alive in the United States. The animal was captured by hunters from a remote village in Burma and Mr. Milton came upon it unexpectedly in the course of his survey. We have now purchased it and it is being held in Burma until it can be flown to Germany later this spring to undergo 60 days' quarantine at an approved sta-

There was no trouble about getting very close to the Takin in order to take its photograph. Here Mr. Estes is offering it a bit of food in a field near the Burmese village of Sankawng.

Photo by Oliver M. B. Milton

tion in Hamburg. An additional 30 days' quarantine will be necessary after it reaches New York. If all goes well, it should go on exhibition in mid-summer.

The article that follows, about a visit to see the Takin, was written by Mr. Estes and appeared in the Rangoon newspaper, "The Nation," in mid-January.

ON THE FIFTEENTH of January the Burma Wildlife Survey team of Oliver M. B. Milton and Richard D. Estes took the regular Thursday flight from Myitkyina to Putao in order to inspect the young female Takin taken last July by hunters from the village of San-

kawng. Acting on behalf of the villagers, the Kachin State Government had offered it for sale to Mr. Milton, and as the New York Zoological Society had indicated its desire to acquire this rare animal for the world-famous Bronx Zoo, we wanted to make sure it was in good condition, as well as take photographs.

But very little time was at our disposal. To accommodate the numerous headmen from the Putao area who were returning from the great Manau held in Myitkyina, the UBA had added two additional flights, one Thursday afternoon and the third Friday morning. To miss the Friday plane would leave us marooned in Ft. Hertz for a whole week, until the regular plane arrived the following Thursday. In such beautiful country, with rugged mountains on all sides, backed to east, north and west by towering snow peaks — some up to 16,000 feet — which appear and disappear through their shrouds of mist and cloud, this might be considered no great hardship. But as it happened, we had to be back in Myitkyina the next day, and but for the fortuitous addition of the extra flights, we would not have undertaken the trip at this time. With such a tight schedule, one thing was clear: if any pictures of the Takin were to be taken, we would have to reach Sankawng well before dark that afternoon.

When the UBA's DC-3 touched down at Putao it was already nearly one o'clock. By the time we had explained the purpose of our visit to the local authorities and registered with Immigration officials, it was close on to two. Having been told that it was a good three-to-four-hour walk to Sankawng, ten miles to the northwest, it looked as though the chance to get pictures was gone even before we started. However, the Assistant Resident rendered timely assistance by supplying his jeep to carry us through Ft. Hertz as far as Putao, where the road ends, thereby placing us two miles nearer our objective.

Beside a footbridge across the Nam Palak River, we left the jeep shortly after two, and with two young men — one from the village — to carry our gear and lead the way, began the forced march to Sankawng. Fortunately the trail led across the level plains of Hkamti and not the surrounding hills; there was nothing to slow our pace except for the streams and rivers, where we had to take off and put on our shoes each time

we crossed. In fact, our progress seemed so rapid that each of several villages we reached, and then passed, raised hope that this was Sankawng. With the sun coming nearer and nearer the rims of the hills, our objective still lay hidden in the forest, until finally, at 4:20, the real Sankawng appeared between the trees. There was still ample light for pictures; indeed, at that moment the sun broke through scattered clouds to light up the whole landscape in rich golden tones.

But, as anyone who takes up the profession of wildlife photography soon learns, it seldom happens that things turn out just the way you hoped. The Takin, we now realized for the first time, was allowed to range free with the village cattle, and of course it could not be located at the present crucial moment. While everyone scurried around, peering under houses, in thickets and other odd corners, we were quietly going mad with impatience. Actually, hardly ten minutes passed before the Takin was found in a clearing behind the two rows of bamboo-and-thatch houses, but in the interval the sun had dipped be-

The young Takin had the run of the fields with the village cattle and apparently was as tame as the cattle themselves. At night it takes shelter under one of the houses in the village.

Photo by R. D. Estes

hind a steep hill that rose immediately to the west, leaving the valley in deepening shadow. Nonetheless, the moment we came within range, we began snapping pictures, even though a growth of bushes and weeds added to the difficulty of getting a good viewpoint.

It was a startling — and thrilling — sight, to come upon one of the rarest and least-known animals calmly grazing with cows, as tame and seemingly as domesticated as they. It was rather like finding a rare alpine flower blooming in a bed of sunflowers. The simile is not inept, for the Takin shares the cold heights where alpine flowers grow, and would never descend to the lowland of its own accord, nor come close to the haunts of man. Moreover, its resemblance to the cattle hardly went further than the fact that it, too, had four legs and ate grass.

With its head held characteristically low, humped shoulders, sharply tapering hindquarters and thick legs, it looked as much like a mountain



goat as anything else, a resemblance that was heightened by the way it moved, and by the stubs, as yet no more than one and a half inches long, of its just-emerging horns. However, the fully developed horns are not at all goatlike, but approximate those of the Wildebeeste or "Gnu" of East Africa, and those of the Musk-ox. The latter, in fact, seems to be the Takin's closest relation.

Found only in Arctic North America, the Musk-ox too, is an odd beast, but despite the name "ox," neither it nor the Takin belongs to the bovine family typified by cattle; rather, they together occupy a special niche in the Subfamily Caprinae in which goats and sheep are grouped. I do not want to dispute this conclusion, seemingly agreed upon by modern taxonomists, whose business it is to classify the different animal species, but to both Milton and myself the "Roman nose," thick face and prominent ears of this little Takin (calf or kid?), definitely sug-

gested a young moose. In short, a Takin looks like almost anything but a cow.

The general color of this specimen — whether of the sub-species *Budorcas [taxicolor] taxicolor* or *B. [taxicolor] tibetana* we do not yet know — was chocolate brown shading almost into black on the face, chin and legs, with a broad saddle of buff spread across the back, and dark dorsal stripe running from shoulders to the short untidy tail. The hair was thick, soft, and quite long. The shiny black hooves, bearing pronounced dew-claws part way up the ankle, were large and strongly curved with a wide gap between, obviously well-adapted to rocky mountainsides. The hooves lend credibility to stories of the Takin's legendary prowess in leaping and climbing the steepest slopes.

After exposing a roll of film each, and fifty feet of motion-picture film, Milton took measurements which showed the Takin's height to be 27 inches at the shoulder, its length 48 inches. As



to weight, we concurred in the villagers' estimate of 90 to 100 pounds. Already nine months old, it had a lot of growing to do before it would reach the 600-700 lbs. which Pocock gives as the weight of a mature animal.

After taking a quick dip in the village stream to wash off dust accumulated on the trail, there was still sufficient light to make some further observations of the Takin. In the interim it had moved of its own accord into the compound surrounding one of the houses. Watching it nibble grass from a few feet away, I was able to see that it had well-developed teeth in its lower jaw and none in the upper, but it resisted attempts to open its mouth for a closer examination. Presently it slipped through the bamboo-stake fence into the adjoining compound, and with slow, long strides approached two yearling calves tethered next to the headman's house, where Milton and I had been invited to pass the night. What happened next caused me to regret keenly that the light was now much too dim for picture-taking. Whether in play or genuine aggressiveness, I could not tell, it proceeded to attack the calves.

The first stage, known as threat display, when an animal signals its intention to fight, could in the Takin's case be likened to the way a dog stalks toward a potential rival. Also, goats behave

The general color of the animal is dark brown, with a broad saddle of buff across the back and a dark stripe down center of the back.

Photo by Oliver M. B. Milton

in much the same manner. Its neck held horizontally, head out and rigid, the little Takin continued her relentless advance until she stood between the two yearlings. They, to my amused surprise, gave every indication of fearing their pint-sized antagonist. Backing and plunging, they only ceased struggling to escape when their ropes had become so entangled that they had no choice but to stand, breathing hard and staring wild-eyed. Even if cattle and Takin are not closely related, certainly the two calves had no difficulty in reading this Takin's intentions!

In the second stage of the attack, the Takin made provocative feinting motions with her head, hooking to the right with what would one day be formidable horns, but which now were ludicrously incapable of inflicting any injury. One of the calves had the gumption to respond to this ultimate affront, and the two sparred briefly head to head before the calf backed off. But though this was repeated several times, the cattle never really entered into the spirit of the thing, and finally became almost frenzied in their efforts to escape. With the Takin between, I became afraid that the tethering ropes would cause some injury.

But she stood there completely unperturbed as though nothing could knock her off her sturdy legs, only occasionally stepping over a rope that pressed too strongly. Even so, I enlisted help to break it up.

As if to show it was all in fun, after all, the Takin now submitted with evident pleasure to having its forehead and chin scratched. Running my hands through its woolly fur, I noted the powerful development even at this age of the neck, shoulders and legs. I noted also a definite but not unpleasant odor of musk, another point in common with the Musk-ox that I had not previously known.

By this time it was dark, and time for dinner. Afterwards, neighbors began collecting in the headman's large (four-room, four-fireplace) house, until it seemed the whole adult population of perhaps twenty-five to thirty people was congregated around the open fires in the two main rooms.

With our guide translating from Nung to Kachin, Milton, an old Burma hand and exceptionally multilingual, got the story of the Takin's capture and taming from the four Nung hunters who had caught it last July. It was taken nine days' walk to the north, in those same lofty mountains, now snow-blanketed, that the lucky airline passenger may see as he lands at Putao. It was then no more than two months old, and the



Measured by Mr. Milton, the Takin was 27 inches high at the shoulder, 48 inches long. It weighed 90 to 100 pounds.

Photo by R. D. Estes

The horns are just beginning to emerge and are only about an inch and a half long. They never become really large.

Photo by R. D. Estes



huntsmen had taken turns carrying it on their shoulders all the way home.

Apparently it never occurred to any of the villagers to use a cow as a foster-mother; yet, amazingly enough, though it never again tasted milk, the foundling had been able to begin grazing at this unnaturally tender age, and to grow into the healthy specimen we had just examined. Taking this as an indication of its hardiness, there would seem to be no reason why it should not thrive at the Bronx Zoo, which is certainly no hotter in summer than Sankawng, where it had adjusted very well.

However, when we learned that it was not confined even at night, both of us registered concern for its safety, as Leopards and Tigers roam in the nearby forest. (Indeed, that same night some prowling animal came near enough to set all the dogs barking, and brought the villagers out with torches and loud cries to scare it off.) But after being assured that the Takin took shelter under one or another of the houses during the hours of darkness, and that care would be taken to see it was always in a safe place, we decided to leave well enough alone, rather than risk having it confined to a pen.

The reward the villagers of Sankawng received for taking a valuable animal alive and rearing it successfully should be a powerful incentive to hunters all over Burma to follow the same practice. The money to be gained from the sale of a rare species to zoos in Europe and America will buy far more food than the animals themselves can yield. A number of much-sought-after species are to be found in Burma, including the Musk Deer, the Serow, the Clouded Leopard, Gaur and Banting as well as the Takin. At the same time, indiscriminate capture of animals, especially if, like the Rhinoceroses, they are extremely rare, should not be encouraged, and areas should be set aside for their complete protection. One of the chief functions of the Burma Wildlife Survey will be to recommend such areas.

In the case of the Takin, there is yet another compelling reason why it should be spared and encouraged to increase, to reverse the continuing trend, which is to kill it simply for the sake of meat, under the mistaken assumption that the supply is inexhaustible. The desire for meat seems always to have outweighed any fear of

breaking the existing game laws, which forbid the killing of Takin, but the fact is that the Takin, while it may be locally plentiful in some places, has a comparatively restricted range in the higher mountains of southeastern Tibet, northern Burma and western China, and could well be brought to the verge of extinction within a few years if steps are not taken to preserve it. The most convincing reason for preserving it is economic, for aside from the demand from zoological gardens, it has a high potential value as a source of meat, milk, wool and hide. Its nearest relation, the Musk-ox, is said to be suited to domestication. The meat is excellent at any age (so is the Takin's), its milk equals the domestic cow's in quality, and the wool is likewise valuable. Although its coat is not so long and woolly, further investigation of the Takin may well show it to be equally suited to domestication.

Dawn of the following morning found Milton and me packed and just sitting down to a high breakfast, prepared at that inconvenient hour by our most accommodating hosts. But it was six-thirty before we got underway, which meant that we would have to maintain the same pace as the day before if we were to reach the airstrip by 9:30 when the plane was due to land, to only remain minutes before returning to Myitkyina. Again, except for the assistance of the Assistant Resident's jeep, we might not have made it by the appointed hour. However, as it turned out, there was no need to rush at all, for the plane was delayed three hours on the Myitkyina field as a result of an electrical fire in the starboard engine. Had there been any way of knowing beforehand, we could have waited in Sankawng until after the sun burned through the morning mist, and gotten really good pictures of the Takin.

But the wait at the airstrip was not without its reward, for just as the plane appeared out of the south, the curtain of mist and cloud rose to reveal the glistening snow peaks curving in an arc behind the forested mountains in the foreground. This was the only view granted us of the Takin's home range. But in the near future we hope to return to these remote mountains, there to observe the life of the Takin in its natural surroundings, and to seek out a suitably grand and beautiful location for a sanctuary where this odd, intriguing animal may be preserved for all time.

Orphanage for Australian Animals

By ROSEMARY FLEAY



WHEN WE FIRST arrived at West Burleigh in Queensland and started the Fauna Reserve in its wonderful setting of glorious bush, with breathtaking views of river, mountains and sea, I had no idea of the work that lay ahead of me. I had reared several young orphaned marsupials before and was well aware of the demands they made on my time, but here I was to care for two young kangaroos, a baby Wombat and perhaps several young birds with open mouths constantly squawking for food, as well as my other work. At one point I took an outside job in an office but found that before long I was cycling to work each morning carrying a box containing two baby wallabys and their milk bottles, biscuits, warm cloths and hot water

Lunchtime for William the Wombat at 3 months. He became the inseparable friend of Wanda, another baby Wombat, but tried to crawl into her tiny pouch, as if she were his mother.

Photos by David Fleay

bottles. I gave up the job, not being able to give it my full time — and of course missing my other animal charges at the Reserve too much.

Every year finds several orphaned kangaroos, whose mothers have been shot, or killed on the roads, sent to us at the Reserve. It is not an uncommon sight to see someone coming through the gates carrying a pathetic little bundle of rags, from which can be seen a pinched little face with liquid brown eyes wistfully peeping at the strange outside world into which it has been thrust from



Five months old now, this little Rat Kangaroo drummed the ground with his hind feet as a warning to intruders, and then attacked by wrapping his front feet about one's legs and nipping sharply. He sleeps all day.

the warm security of mother's pouch. We have always done our best for them, but very often nothing could be done when they had been fed on undiluted cow's milk or perhaps had been handled overmuch by people who were trying to help them, probably feeling a bit guilty about the slaughter of the mother kangaroo. If the joeys had a covering of fur there was always a good chance of their survival, but with all young marsupials one could never forecast their future prospects with certainty. The slightest stomach upset, change of daily routine or a sudden rise or drop in the temperature, causes a chill in most cases. Then all the drugs and constant attention one can give are practically useless.

We have successfully reared quite a few of these soft-furred, brown-eyed, gangling youngsters and have of course become very fond of them. Many a time I would hear a thump on my bedroom floor during the night, then thump, thump, thump, accompanied by a squishing cough as an orphan kangaroo tumbled out of its warm bed and hopped about, calling and searching for secure cosiness once again. The only thing to do was to get up and prepare a nice warm bottle of milk for the tiny mite, bed it down once again and try to snatch a few more winks of sleep before rising and filling many more hungry mouths on a new day.

A Great Gray Kangaroo youngster came to us from the southern coastal region of Queensland. We named him Sandy MacNab and before long he became my constant companion, following me about and making soft clucking noises in his

mouth to express approval of his meals. All too soon the time came for him to be put into the large kangaroo enclosure with the adult kangaroos, where visitors could mix with them and pat the animals as long as they did not try to tease them. However, several people have violated this rule with unpleasant results. One day we heard a terrific commotion and raced to the scene to find that Sandy had taken a violent dislike to a man who had obviously been teasing him. Sandy, rearing back on his tail and wrapping his hairy arms about the man, was ripping downwards with his powerful hind feet. The man's shirt was already torn and he was very glad to be freed from the kangaroo's clutches. As a result of his rough tactics, Sandy MacNab now resides with other "outlaw kangaroos" in an enclosure with the Emu flock.

George, a fat and cheeky little Rat Kangaroo, came to us in a box containing a hot water bottle, a bottle of milk and a juicy golden pineapple for our own consumption. A kind pineapple grower sent him to us after coming across the dead mother Rat Kangaroo with the terrified George in her pouch. He thrived on a diet of sweet potatoes, mash, and of course a daily dish of milk. He snoozed away the daylight hours in a self-dug hole, lined with grass which he carefully collected and carried rolled up in his short, thick tail. If anyone dared enter his enclosure during his moonlight meanderings, he would approach, drumming first one tiny hind foot then the other on the ground, with footwork which would do credit to any prizefighter. After this warning he

would attack, wrapping his front feet around one's legs and nipping sharply.

A young Silver-Gray Possum joined the nursery and did several Houdini escape acts from his box in my bedroom. One morning he disappeared and could not be found anywhere. After searching unsuccessfully most of the day I was feeling very sad at the thought of the helpless mite wandering aimlessly in the bush and perhaps falling victim to a hungry fox. I went to a wardrobe to don a coat before starting a night search, and upon putting my hand in my pocket came in contact with a snug but very hungry little possum. He seemed very pleased with himself at finding a ready-made pouch. He was liberated when grown but many of our pet possums have refused to leave the house after being set free. One complete family lived in the roof of our home, making nightly excursions to raid the fruit in the store shed. Two great pets, Timmy and Nosey, were liberated half a mile away and my

brother awoke one night to find they had returned to the house and taken up residence in his bedroom. Yet another possum found its way into my father's room and he awoke early one morning to find himself staring into the brown, beady eyes of a baby possum which was sitting on his pillow, quite happily cleaning its whiskers.

Perhaps my most entertaining "foster child" was Dizzy the Dollar Bird, who was found on a hot bitumen road when a fledgling, and rescued by a kind motorist. Dizzy had barely a feather and was a pitiful sight but he soon regained his strength and like all young birds continually clamored for food. Juicy grasshoppers and beetles made him yell all the more and his "machine gun" voice seemed to wind up into a crescendo at the sight of them. As he grew, his drab gray feathers changed to a distinctive blue-green with silver dollar spots under each wing, which give the name of Dollar Bird. When he was old enough we liberated him, thinking that he would join his own kind and migrate north with them on their annual search for the sun. But not Dizzy. He found himself a favorite perch on the roof and whenever I ventured outside the door I was

Strangest of the animal friendships that developed among the Fleays' animals was that between a white Emu chick and a tiny Red-necked Wallaby.



greeted by his staccato voice, which became louder and more joyful as he arrived in a flurry of feathers on my head or shoulders. I missed his cheery welcome one morning and although we searched the place, no trace of him could be found. We were all very sad, for Dizzy had afforded us many laughs with his vociferous welcomes and his many narrow escapes when he accidentally landed in other birds' enclosures. Many a time his irate voice, scolding loudly, would bring us to the rescue to find him being held aloft in a larger bird's beak. However, the last few Dollar Birds flew north in the week of Dizzy's disappearance, and we could only hope that he had winged on the journey with them.

Wanda and William, the Wombat babies of two years ago, were inseparable when tiny and were a comical pair, always getting into mischief together. It was a common occurrence to find them climbing the front stairs and searching for discarded chewing gum, for they delighted in getting themselves as sticky as possible. I always had the utmost difficulty in keeping them away from the deep rain-gutter, which held a fascination for them. They once escaped me and were found clinging on for dear life to the edge of the gutter and "squishing" loudly for help. Wanda was much larger and several months older than William, and he was always making hopeless attempts to crawl into her undeveloped pouch, as if he were sure she was his mother. Finally they quarreled, and Wanda, having advantage in weight, trounced William. Now they are separated and they snarl at each other with loud, wombat cussing noises when attempts are made to reintroduce them. For the time being, anyway, it is the end of a beautiful friendship.

Irene was a Black-backed Magpie that joined the family and created many disturbances. She had the freedom of the Fauna Reserve and strutted about keeping a keen eye on everything that was going on. If any boisterous children tried to pick her up, she would suddenly drive her sharp beak into a hand or leg and strut away in a very dignified manner, clucking to herself indignantly. If a cage was being cleaned, or an animal fed, or perhaps the Platypus show was in progress, Irene made a point of attending. Arriving at the scene, she would throw her head back and deliver a magnificent crow which would

do justice to any rooster. Once when feeding the baby Wombats on the lawn I was dismayed to find that Irene had stolen and swallowed the rubber top of their feed bottle, mistaking it for a juicy worm. It didn't harm Irene, but it took a week or so before the Wombat babies would feed properly from a new bottle top. At dusk every evening Irene would arrive like a rocket through the kitchen window and perch on the curtain pole. From there she would watch everything, seeming to like our company. When a stirring march or perhaps her favorite Spanish Flamenco music was playing on the radio, Irene would put her head back and "swing" in time to the music, ending up with a happy little crow. She would continue this concert until sleep overcame her and she tucked her head underneath one wing and dozed off.

In the morning Irene would open her eyes, fluff up her feathers and after preening herself would, if not watched, make a tour of inspection of the breakfast table. One morning she sampled the butter and jam, then walked through father's plate of porridge before being caught and put outside. It was a sad day when Irene disappeared and after looking and listening for her cheery warbling we finally gave up hope of finding her. A fortnight passed and during breakfast one morning we heard a familiar crowing noise outside the front door and opened it to find a very bedraggled Irene on the doorstep. She was thin and had had her wings clipped by whoever had caught her, so she must have walked back home. We were overjoyed to find her, for although she was an awful nuisance we were all very fond of her and regarded her as almost one of the family.

Some young animals and birds formed strange partnerships when reared together. An interesting association which still exists was that of our rare white Emu chick, Snow White, and a tiny Red-necked Wallaby, Jennie. They grew up together and found great comfort in each other's company. Whenever they became separated the Emu ran up and down, frantically uttering shrill piping notes. Jennie fretted too. Each evening they bedded down together, the wallaby with her feet underneath Snow White's feathers and her tiny forepaws dangling over the Emu's neck. Although the Emu is now almost fully grown — as Jennie is, too — they are still great pals.

ZOO NEWS IN PICTURES

Photographs on this page
by Henry M. Lester; others
by Staff Photographer Dunton



LIONS are a good deal like people. Some are naturally even-tempered and some are stand-offish and irascible. These two photographs are good illustrations of two varying temperaments among the five cubs we acquired in January as eventual replacements for the elderly Lions now living on Lion Island. One of them, while not tame and gentle to the point that it voluntarily offers to play with its keeper, nevertheless regards him with interest, is not afraid and has a "sweet" expression. As for the cub pictured at the top — well, if it didn't snarl constantly, its keeper would think it must be sick! These studies were made in the Animal Nursery by Photographic Consultant Henry M. Lester while testing a new "zoom" type of lens for 35 mm. still cameras.



This is the first specimen of **PALLAS'S CAT** we have ever had — and it is a beauty! As well as rare. It comes from the Siberian steppes, the Mongolian deserts and the highlands of Tibet, is supposed to feed for the most part on small rodents, and at one time (but no longer) was supposed to be the remote ancestor of the domesticated Angora or Persian breed of cats. With its long, soft, fluffy, tan-and-grizzle hair and heavily-furred tail, it looks as if it might be — if some of the temperament were bred out of it. A hiss, a growl and a hard, explosive spitting sound, accompanied by a short dart toward an intruder, are characteristic. While the cat was still in the Animal Hospital, waiting until a place could be found for it in the Small Mammal House, it invariably reacted to its infrequent visitors by a darting rush forward, a loud “thutt!” and a rumbling growl. These are apparently merely manifestations of its uneasiness at the new and strange surroundings, and they are wearing off. Indeed, although it pretended to spring at Keeper Waltz when he opened the compartment door, he could stroke it gently with a gloved hand and it made no attempt to bite or scratch. Probably it will become completely at home in a short time. Eventually we hope to obtain a mate for it. One is now on order.

This ungainly creature, now on exhibition in the Reptile House, is the **LARGE-HEADED RIVER TURTLE**, *Batrachemys nasuta*, from northern and middle South America, and is the first one we have ever exhibited. It is a rare member of the side-neck turtle group and is believed to be an adult, with a shell about 10 inches long. There was some difficulty about feeding it at first, but eventually it began to eat clams, and now takes fish readily. Most side-neck turtles seldom come out of the water, but this one occasionally does.



Thanks to Kipling and his Rikki-Tikki-Tavi, the Indian Mongoose is an animal that almost everybody knows by name — but which few Americans, at least, know by sight, for its importation into this country is forbidden by law. However, the **AFRICAN MONGOOSE**, or **ICHNEUMON**, is not proscribed and we have recently received our first specimen of this interesting animal through the courtesy of the National Zoological Park in Washington. *Herpestes ichneumon* is considerably larger and darker than the Indian Mongoose, *Herpestes auropunctatus*. Our animal is not entirely tame, but it is quiet and steady and is apparently thriving in its new home in the Small Mammal House. Its native home is non-desert Africa, ranging into Spain, although it does not seem to be common anywhere. In the wild it eats small mammals, birds and reptiles, but is doing well in the Zoo on meat and eggs.



Wildlife Challenges in East Africa

By NOEL SIMON

Chairman, Kenya Wild Life Society

The article that follows is the text of an address given by Noel Simon at the North American Wildlife Conference in New York in March. It was prepared by Mr. Simon and George Treichel, the Wildlife Research Associate of the Zoological Society and The Conservation Foundation, and is published here because it states clearly and succinctly what the problems are that now face the friends of African wild life, and suggests what can and must be done.

BRITISH EAST AFRICA, an area one-fifth the size of the United States and comprising Uganda, Tanganyika, Kenya and Zanzibar, is generally regarded as a part of the world populated with vast numbers of spectacular wild animals. Fifty years ago this was quite true and in 1907 the railway running from the Indian Ocean deep into the interior of Uganda advertised that its "observation cars pass through the greatest natural game reserve in the entire world." But in more recent times, particularly since the end of the last war, the great pace of development coupled with an astonishing numerical increase in the African population have altered the natural environment until today only a few restricted localities support significant stocks of large mammals. Not only are the remaining wildlife habitats being progressively reduced in size, but at the same time relentless human pressure on the fast-diminishing remaining herds—in the form of large scale poaching—is having disastrous consequences.

To illustrate the significance of the current illicit slaughter of wildlife, it is necessary to explain that in the great Serengeti National Park in northwestern Tanganyika, which is generally regarded as the outstanding sanctuary on the en-

tire African continent, a 1958 census has revealed less than 400,000 large animals of all species; this is an area where it has been fashionable to speak of millions of animals. It is important to note that this is the *only* wildlife concentration of its kind remaining on the entire African continent today, for there is no other place where even 100,000 head can be noted; yet 25 years ago there were several. To see this in its correct perspective, it is necessary to add that this figure is considerably less than the annual harvest of white-tail deer in the United States. Furthermore, the Director of the Tanganyika National Parks estimated that not less than 150,000 wild animals were killed by African poachers in and around the Serengeti National Park in each of the last few years.

The recent major anti-poaching operation in eastern Kenya disclosed the extent of poaching of elephants in the Tsavo National Park and adjoining Coast Province. In one relatively small area no less than 1,280 elephant carcasses were discovered, and it was estimated that approximately 3,000 elephants have been destroyed by poison arrows in this region during the past three years. The peak seasonal elephant population in the Tsavo Park is estimated to be about 4,000, so it is very apparent that if poaching is allowed to persist at this rate, there can only be one outcome.

Several other species have had serious population reductions and are in jeopardy. Dr. Fraser Darling and Dr. Bernhard Grzimek each inde-

Snow-covered Mount Kilimanjaro looks down on the plains of Africa, where the great aggregations of wild animals are fast disappearing. This striking scene is in the Nairobi National Park.

Photo by Ylla, from "Animals in Africa"



pendently stated that they would be surprised if more than 1,000 black rhinos remain in Kenya today, yet only ten years ago a member of the Game Department was employed to shoot over 900 rhinos in the Makueni area alone, to make way for an African agricultural settlement scheme. In the Mara region, the finest lion country remaining in Kenya, there are not more than 250 lions today. This is the situation in a part of the world which many think is still overrun with wildlife.

The only hope for the future of wild fauna in East Africa lies in a two-fold program. First, the acquisition of basic factual data — at present noticeably lacking — on which proper long-term management programs can be based. Second, but equally important, measures must be taken to win the African over to the realization of the value of wildlife conservation.

The solution on which all else ultimately depends concerns the attitude of the African himself. For unless we make the effort in the years immediately ahead to alter the present attitude of the Africans, there can be no hope. The attitude of the more advanced African was adequately summarized by an African politician who stated that the presence of wild animals merely served to remind him of his own primitive past which he earnestly wished to forget. Therefore, to eliminate this primitive past, it would *ipso facto* be necessary to destroy the animals with which that past was associated. The less sophisticated African has an insatiable craving for meat which can only be appreciated by those who have witnessed it. A combination of a rapidly expanding African population endeavoring to satisfy this craving for meat on a rapidly diminishing number of wild animals can have only one result.

If any effective long-term preservation plans are to be taken it seems logical to suppose that the African must first be converted from his present attitude of mind and convinced of the value and worth of the fauna around him. This is nowhere near as simple as it sounds, but unless it is done there is little hope for the continued survival of wild animals outside the few national parks and sanctuaries. It is fundamentally impossible to put an end to the unnecessary and

wasteful slaughter of animals without the active cooperation of the African himself.

It has been suggested that this could best be achieved by education, particularly in the schools through the medium of films, publications and lectures. This suggestion is admirable insofar as it goes but even the most ardent protagonist of this approach to the problem must concede that it will be a very long time before such methods produce worthwhile results, and by that time there may be precious few animals left to conserve. After all, it is expecting a great deal to completely alter the inborn belief of countless generations of Africans that the only useful wild animal is the one in his cooking pot. By all means let every possible method of converting the African by education be explored, but let it also be recognized that this is a long-term policy. How can an African conceivably become pro-game when he derives no benefit from its protection? How can he be expected to understand or appreciate aesthetic considerations or even that the preservation of wildlife is of great material benefit to the country as a whole? Many Africans, particularly the pastoralists, consider that they are expected to preserve wild animals on their own land for the benefit of a few wealthy Europeans and that they themselves derive no benefit whatever from the arrangement. This naturally causes resentment. There is only one argument to which an African can *at present* be expected to respond and that is the simple expedient of seeing for himself that he personally derives material benefit through the preservation of wild animals.

In East Africa it is unlikely that wild animals will be allowed to survive for any length of time purely for aesthetic reasons and unless it can be shown that these wild creatures can contribute directly or indirectly to the economy, they will eventually be compelled to give way to more profitable enterprises and the inevitable needs of human expansion. In order to insure the survival of the greatest possible number of wild animals, it is necessary to remember their right to live will be judged largely in relation to their economic status. In the case of national parks, this condition is already fulfilled in that these parks bring in considerable revenue from the tourist trade. But the present system of national

parks does not adequately conserve sufficient examples of East Africa's varied habitat and wildlife, and it is for this reason that game management zones must be created. In this connection, it is necessary to emphasize that this concept is based on the belief that certain areas of East Africa would yield a more profitable return to the country as a whole under wild fauna than under domestic livestock. This precept is undeniable, although it may not be easy to convince Government of its wisdom because of political and other considerations. The question is basically one of proper land utilization.

Ideally, each national park should be surrounded by a game management area (although this will not always be possible to achieve), the latter acting as a form of protective outer barrier for the central kernel of the Park proper. In these game management zones it will be necessary to adjust our thinking and accept the fact that there is nothing morally wrong in harvesting an annual crop of wild animals, in precisely the same way as a farmer has no compunction in marketing his excess cattle or sheep every year. This idea is well known to American wildlife experts, but it is a new idea in Africa. At the same time, poaching might well be reduced to smaller proportions than is the case today. Furthermore, the African would be ensured of his meat requirements.

The only solution for maintaining significant stocks of wild animals outside of the protected limits of the national parks lies in some form of partnership with the African, aimed at securing his cooperation through participation. He must be enabled to see for himself the direct benefits accruing from a sound wildlife conservation program. With this in mind, the Kenya Wild Life Society has proposed setting up a pilot game management project for the benefit of the Waliangulu tribe in eastern Kenya. This project is based on harvesting an annual surplus of wild animals on a sustained yield basis. It is, in fact, a protein-production project designed for regions entirely unsuited for domestic livestock or agriculture in the normally accepted sense, with all proceeds going to the African participants. Along these lines lies the future of Africa's unique wildlife heritage outside of the national parks.

The Waliangulu are a small tribe living in Kenya's coastal hinterland whose traditional

way of life has been the hunting of wild animals. Until very recently they hunted only for the pot and their own immediate needs, but have now taken to hunting on a large commercial scale, dispensing the ivory and rhino horn through a well organized ring of Asian receivers and leaving the carcasses of their victims to the hyaenas and vultures. As a result the Waliangulu are virtually poaching themselves out of existence by destroying their own means of livelihood. The Waliangulu poachers receive a mere pittance for ivory and rhino horn on the black market. As the average weight of ivory is 20 pounds per tusk recovered, the poacher receives something in the neighborhood of \$25 per elephant, whereas an elephant if properly utilized is worth at least \$300. If steps can be taken to legalize and *control* (on a cropping basis) the slaughter of elephants, the Waliangulu will be able to receive the full market value of the elephants and will, therefore, receive a far larger financial return for killing considerably fewer animals. By this means their traditional way of life will be maintained, stocks of wildlife safeguarded for the future through proper management and the black market run out of business.

There is a definite possibility in this area of utilizing existing wild animals as a form of continuing protein production for the benefit of the native inhabitants. In certain under-developed areas, chiefly arid and some tsetse regions, the harvesting of wildlife would be a far more satisfactory method of obtaining protein than would result from the farming of domestic stock. It would also be a wiser form of land use. In Africa, international development organizations have made considerable sums of money available for building up fisheries as a source of protein, but little if any thought appears to have been given to the possibility of utilizing wild animals as a productive source of protein for the benefit of the native inhabitants in areas notably deficient in protein.

The time factor is most important; every possible step should be taken to commence this Pilot Project with the least possible delay. If successful, there is no reason why similar projects should not be undertaken elsewhere for the benefit of other tribes. By this means a number of areas at present useless from the point of view of normal



husbandry and merely serving as poachers' playgrounds could become highly productive, benefiting not only the tribesmen themselves but the country as a whole. At the same time, although almost incidentally, fresh zones would be created in which large numbers of wild animals would be enabled to survive for the benefit and enjoyment of future generations.

It would, of course, be out of the question to think in terms of instituting game management programs in heavily populated native reserves. Game management zones are suggested only for those arid, semi-desert tracts which are never likely to be capable of supporting more than an extremely limited number of people and then only at bare subsistence level; in these zones any form of economic animal husbandry in the accepted sense would be out of the question. Any-

one who has seen this poor, waterless portion of the country will realize that its wisest use would likely be in some system of game management. Wild animals have lived there for countless generations without damaging the vegetation and soil. Certain tsetse fly regions would also be eminently suitable for game management projects. It seems strange to think that substantial sums of money are being spent in eliminating species of wild animals eminently adapted to some of the tsetse fly areas in Africa and attempting to replace them with domestic animals which are entirely unsuitable, and which are unlikely to yield as big a return in terms of protein.

It has become apparent that if East Africa is to succeed in preserving its fauna, it is going to need the help of a small but permanent team of biologists who will increase the strictly limited

knowledge of animal habits and requirements. This permanent research team might be started by obtaining the services of qualified United States, Canadian and British ecologists for specific projects. Here is an entirely new opportunity for field research of a kind never seriously attempted before in Africa *on a permanent basis*. Without the factual knowledge that trained biologists can provide, East African countries stand in grave danger of making faulty decisions and adopting wrong policies. In particular, the services of expert grassland and wildlife ecologists who will help increase knowledge of *range management* are needed.

East Africa possesses research organizations for most of its essential resources — agriculture, forestry, fisheries, and so on — but a similar organization for wildlife is noticeably lacking. This is because the conception of managing wildlife as a natural resource is a very new idea in this part of the world. It is a strange paradox that East Africa, which possesses the greatest and most varied wildlife resource to be found in the world, should possess so little essential knowledge of the requirements and needs of that resource. Undue emphasis is placed on controlling the kill, and

Poaching for ivory — which often means that the meat is not used at all — is widespread and a real threat to the existence of the African Elephant. This ivory was seized by the Belgian Congo government.

not enough on understanding and managing the range and wildlife populations. Long-term wildlife range management programs have not yet been initiated in Kenya, Uganda or Tanganyika. In some European countries, and particularly in the United States and Canada, wildlife management problems which East Africa is only just beginning to comprehend have been tackled vigorously for many years. Some of these solutions could, with necessary modification, be applied to parts of Africa. Our greatest — and one might add desperate — need is to establish facilities for a permanent faunal research organization in East Africa. The valuable investigations recently undertaken by Drs. Petrides, Swank, Buechner and Longhurst of the United States, Dr. Darling of the United Kingdom and Dr. Grzimek of Germany, must be continued.

Unfortunately, there is insufficient local government money available to invest in a permanent wildlife research organization, for with very limited budgets, top priority in expenditure is invariably given to projects having more immediate benefit to the African inhabitants — schools, hospitals and agricultural programs. There is relatively little available for national park developments and the proposed wildlife management programs; for example, the total Kenya budget covering *all* government services last year was less than the funds allocated in the United States for the National Park Service alone. The United States is the only country in the world with the will and the means to provide assistance and technically trained men to begin a permanent wildlife research organization. This does not mean that East Africans intend to relieve Government of any of its financial obligations, but rather that they should tempt Government to provide for these additional new services on a matching basis. The United States not only pioneered the national park movement but in more recent times has been instrumental in formulating and developing the concept of maintaining wild land as a recognized and legitimate resource. East Africa could profitably import some of the techniques so successfully developed in North America.

In summary, the present wildlife situation in British East Africa is critical and unless adequate measures are taken as a matter of urgency, another decade or two may well see the total elimination of wildlife in this part of the world except for scattered remnants in a few isolated token regions. In many parts of Africa the effort to conserve wildlife has come too late. In ten years' time it may be too late for East Africa. Wildlife management on a scientific basis is required as a matter of urgency. Technical and financial assistance are needed, for time is quickly running out on the most spectacular remnants of the world's wildlife. This state of affairs represents what may justifiably be regarded as the greatest challenge in the field of wildlife conservation since the near-elimination of North American bison herds late in the last century. The next five years are vital because unless sound policies and practices can be determined and applied within that period, we shall have missed the opportunity which, if lost, will never be repeated.

What Birds' Nests Tell us

By EDWARD A. ARMSTRONG

Author of Bird Display, Birds of the Grey Wind, etc.

WRITERS OF POPULAR BOOKS about birds at the end of the last century tended to regard them as incomplete unless they introduced a disquisition on birds' nests with, perhaps, a little moralizing about the ingenuity of these "feathered craftsmen." Nowadays when almost every aspect of bird life is discussed in books and scientific papers there is very little written about nests. Yet they are of great interest. Apart from other considerations, the very existence of a species depends ultimately on its placing its eggs in a sufficiently safe site. Birds are most vulnerable at nesting time. Inefficiency then spells extinction.

Birds are much more adaptable in choosing sites for their nests than in changing the form of the nest to suit altered conditions. The Duck Hawk which usually nests on a cliff ledge may choose the roof of a skyscraper in a Canadian city or bare ground on Siberian tundra. The Red-winged Blackbird normally breeds in swamps but on small islands may nest in trees or even in holes. Every field naturalist can recall finding nests in odd situations. Adaptability in nest site selection is excellently illustrated by the House Martin which in Europe has taken to nesting on buildings to such an extent that the discovery of a colony on a cliff, the ancestral nesting site, would deserve recording in an ornithological journal.

On the other hand, there are strict limits within which the form of a nest varies and exceptional divergences from the standard pattern are rare. Even then they can usually be accounted for by interference of some kind with the normal procedure, such as the illness of the bird or the unsuitability of the nesting site. More than a century ago the Scottish poet James Montgomery wrote:

All the wing'd habitants of Paradise,
Whose songs once mingled with the songs of angels,

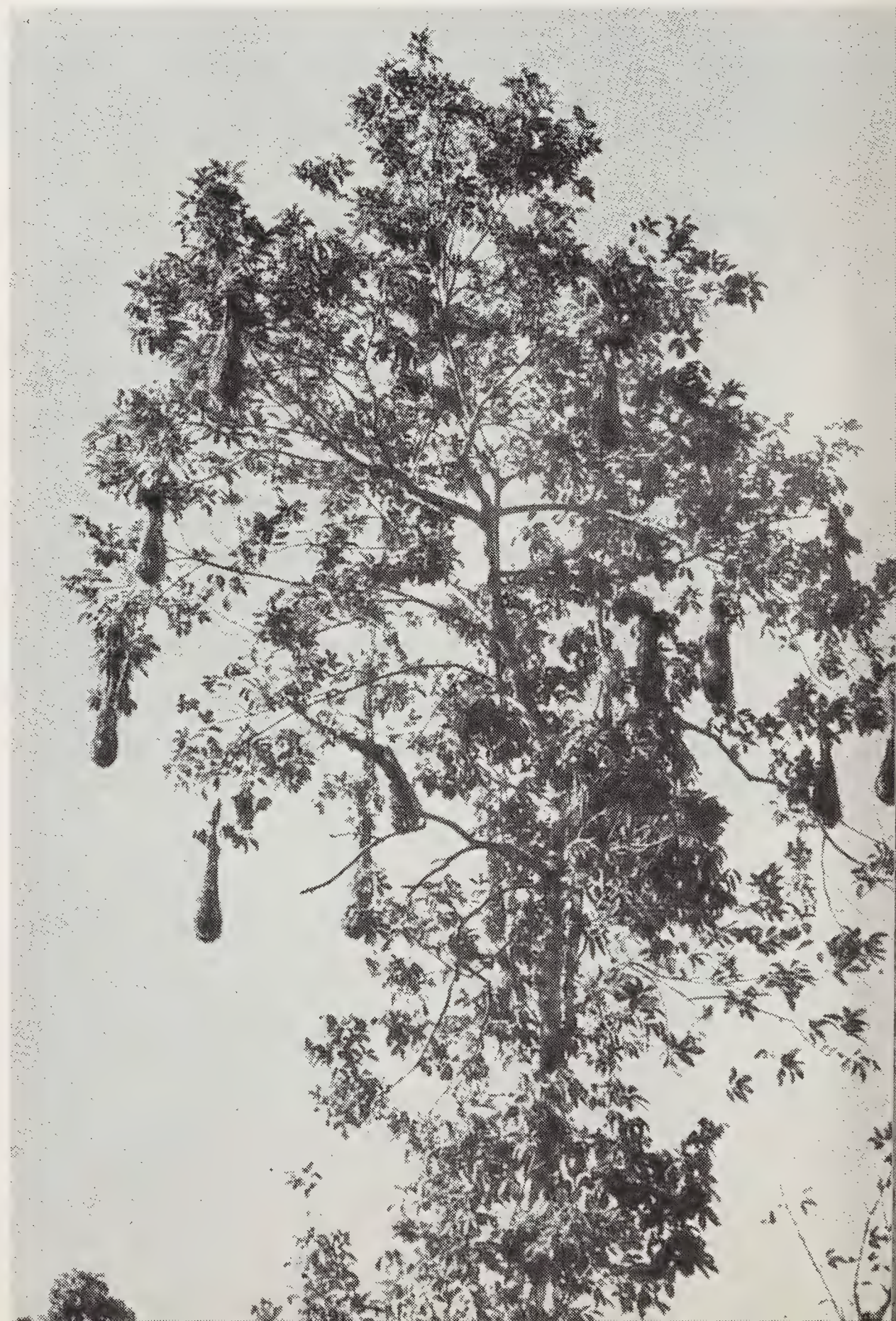
Wove their first nests as curiously and well
As the wood minstrels in our evil day,
After the labours of six thousand years,
In which their ancestors have fail'd to add,
To alter or diminish anything.

Montgomery died before Darwin published his views on natural selection, showing that fixity of behavior was apparent rather than real, but if we seek illustrations of prolonged stereotyping of behavior we can hardly find a better example than that chosen by this old Scottish poet.

The fixity of nest pattern as compared with the modifiability of other aspects of behavior and structure is beautifully illustrated by considering

Below. — Green Caciques like to nest in large colonies, and here their nests dangle from a tree in the forest at Rancho Grande, Venezuela. Right.—A baby cacique, close up, peers from the tiny nest opening.

Both photos by William Beebe



what happened when a few birds arrived and established themselves on birdless islands far out at sea. The Honeycreepers of Hawaii are descendants of a few storm-driven waifs. In process of time and through the operation of natural selection these birds' descendants have evolved into 22 species which differ in size, songs, feeding habits and particularly in the shapes of their bills, some having long, curved sickle-form beaks, others having bills nearly as stout and short as a Grosbeak's. The nests of all these birds are very similar. Again, in the Galapagos Islands the descendants of the original immigrant finches have become differentiated into a "warbler" type, a "woodpecker" type, and so on. One has even acquired the capacity to use a cactus spine as a



tool to poke insects out of crevices, but there is extremely little difference between the nests. Evolution is relatively rapid in such conditions and the absence of predators reduces the importance of choosing a nest site as nearly inaccessible as possible, but the outstanding fact is that the nest pattern has remained unchanged when almost all other outward characteristics have varied.

The Redwing or Red-winged Thrush of Europe and the American Robin are related. One has evolved chestnut red flanks and the other a red breast but they both build similar types of

nest, lined with mud overlaid with dry grass. The Winter Wren of North America and the wrens of Europe and Asia are all of the same species and it is now accepted that the wrens of the Old World are the descendants of the pioneers which crossed Bering Strait. The wren of Iceland is larger than the Winter Wren and has a different pattern of song but apart from the nest being slightly larger it is similar to the nests of American and English birds. When wrens build in nesting boxes they make a roofed nest as they do when they build in a bush.

On the other hand the English Sparrow, which might better be called the House Sparrow, a bird usually choosing cavities for its nest, makes a domed structure when it nests in small trees or bushes. Thus even when the customary nest site changes, alteration in the nest pattern tends to lag behind. The House Sparrow used to be classed with the finches but now it is placed with the weavers. This classification is supported by the roofed type of nest. The weavers are mainly tropical and most of them build covered nests. This bird is sometimes spoken of as "ubiquitous" but, as is well known, its presence in many parts of the world is due to introduction by man. It is not generally realized that in ancient times man was indirectly responsible for extending the sparrow's range. Before agriculture was practiced the bird must have been confined to a relatively small area. In Neolithic times human activities, such as cultivating grain and erecting buildings, provided it with food and shelter. We may assume that as man subdued the forests the sparrow advanced northwards. In Europe it is doing so still. Where railways, roads and dwellings have recently been built north of the Arctic Circle it has followed.

When House Sparrows build in bushes the nests are rather untidy. This suggests that through long adaptation to crevice-nesting the species has lost much of its competence in weaving materials. The House Wren, one of the few species of wren to build in cavities, merely packs twigs and other materials into the hole. We may presume that its adaptation to cavity nesting is more ancient than the House Sparrow's and has proceeded further. Although birds show great tenacity in retaining a type of nest it seems that they can lose ability to build more rapidly than



The Red-winged Thrush and the American Robin are related and they both build rather similar nests, mud-lined and overlaid with grass. This is the Red-wing's nest and young.

Photo by the author

they can acquire it. Too, birds of prey differ greatly in size, coloration, feeding and other adaptations but practically all build the same type of open nest except those species which hardly make any nest but choose cavities, ledges, flat ground or the deserted nests of other birds.

The wren's ancestry, like that of the House Sparrow, is, as we shall see, tropical. Is it coincidence that these two birds should both build domed nests? On the contrary, such nests are relatively common in the tropics. There are two outstanding types of covered nest — the globular or ovoid and the pendent bag types, both usually having the entrance at the side or near the bottom. There is a third typical form — the hammock type — a long pocket suspended from twigs with the entrance at or near the top. Compared with the other types it does not shelter the contents so completely but has the advantage that the brooding bird cannot readily be trapped in the nest.

It would seem that clues provided by the form of nests, if used with discretion, can provide useful evidence of the ancestry of birds and the areas in which groups evolved. According to the extent to which supplementary evidence is avail-

able, greater or lesser degrees of probability can be attained. The range of the wren *Troglodytes troglodytes* extends throughout most of the temperate regions of North America, Europe and Asia but its relatives are most abundant in the New World tropics. The nests of most of them, whether they nest in deserts, like the Cactus Wren, or in swamps, like the Marsh Wrens, are globular or ovoid. Far removed geographically from the Americas as the wrens of the Altai Mountains may be, their structure, behavior and the type of nest they build all indicate that their ancestry must be traced to the warm areas of the New World. We cannot be so certain concerning the ancestry of the dippers which also range over mountainous areas of temperate Europe and Asia but in North America are found in regions in the west, though they extend southwards to northwestern Argentina. Some experts have considered them as related to the thrushes and their classification is still a matter of discussion. But if we put together all the evidence, suggesting an affinity with the wrens, including the globular nest-form, similarities in form and display as well as distribution, it would seem most likely that they spread from the New World to the Old.

Kennicott's Warbler, which breeds in Alaska, is a subspecies of the bird known in Europe as the Arctic Warbler. Like the birds which nest in Europe and Asia it winters in tropical eastern Asia. In spring the Old World Arctic Warblers set out on an astounding journey from their win-

ter quarters in the Philippines, Indo-China, Indonesia and Malaya. Going through China they cross the continent of Asia, some of them reaching northern Norway. This species is one of the leaf warblers and, like its relatives, builds a domed nest on the ground. Although it nests beyond the Arctic Circle and related species breed in temperate Asia and Europe, its adherence to wintering in southeastern Asia, together with other indications that the leaf warblers originated there, suggest that it, too, is of tropical ancestry. Once again, the domed nest provides an additional clue.

Experts are not agreed as to whether the Long-tailed and Penduline Tit of Europe are related, or, indeed, as to whether they are properly classified with the tits. These two species are the only European birds which build enclosed, felted nests. This, and other similarities of behavior, suggest that those who think the two species unrelated may be mistaken. At all events, it is highly probable that the ancestry of both can be traced to the tropics. There are several African species of Penduline Tit.

The third type of nest with which we are concerned, the hammock-pocket, is constructed by a number of tropical birds, including some hummingbirds. It is the type of nest built by the Baltimore Oriole in the United States and the Golden Oriole in temperate Europe. These birds are placed in different families and thus are not regarded as very closely related. Both families have a large number of tropical representatives and so we may reasonably assume that here we have birds which, one in the New World, the other in the Old, have brought their nest pattern from the south. The problem is more difficult in regard to the other hammock-nesting birds of the northern hemisphere — the kinglets. They are predominantly northern birds, though the Golden-crowned breeds as far south as Guatemala. Yet the form of the nest suggests that it would be worth while to look for other indications that these birds also originated in warm countries. It seems to be much easier for tiny birds to evolve in the tropics than in colder areas. The smallest

birds of the world, such as the hummingbirds, are mainly confined to the tropics.

Why should so many birds of the tropics or of tropical origin build nests of one or other of these three types? Even in temperate regions direct sun shining on a brooding bird will reduce it to great distress. This applies even more strongly to the tropics where the sun's rays would quickly kill the embryo in exposed eggs of small birds. However, this cannot be the principal reason why birds build covered nests, for the nest site chosen by the smaller species in the tropics is usually sheltered from direct sunlight. The contrary explanation has more plausibility — that the covered nest conserves heat. If this were its main function one would expect it to have become a common type in higher latitudes but, as we have seen, this is not so. The covered nest appears to be an adaptation to hot climates.

There is an interesting special case. If a male bird has several mates he cannot give regular help at the nest of all of them. The females may have to do all the incubating, tending and guarding of the young unaided. Eggs or chicks are left unbrooded for longer intervals than when the male cooperates. Thus we find that a number of

A cavity nest is constructed by the Willow Tit of Europe. This gives considerable protection, for the opening is so small that only a small predator can enter, and it is inconspicuous.

Photo by the author



polygamous species, such as the wren in favorable habitats, the Penduline Tit, some Indian and African wrens and Wagler's Oropendola of Central America, build covered nests of vegetable material. Others, such as the Pied and Col-lared Flycatchers of Europe, build in tree cavities.

The main function of the types of nest we have been considering must be to conceal and protect their contents from marauders. In sub-arctic forests there are only a few arboreal nest-predators such as squirrels and birds of the crow family but in tropical forest there are many, including whole groups, such as monkeys and snakes, which are absent from northern forests and even in northern temperate regions are not serious enemies of tree-nesting birds. In the tropics birds can foil such predators to a considerable extent by hanging their nests at the tips of branches, as is done by several species of weavers and Penduline Tits. I have seen a band of howler monkeys near a group of nests of Wagler's Oropendola at Barro Colorado in the Panama Canal Zone but these agile acrobats, equipped with prehensile tails, could not reach them. The large nests of Oropendolas are very conspicuous as they dangle from the branches but other pendant nests, such as that made by the Tailor Bird of leaves sewn together and of some hummingbirds which hang their hammocks beneath the huge leaves of tropical plants, are very difficult to find. The strong, closely woven nests of Oropendolas and Weaverbirds survive tropical breezes but this type would be unsuitable in northern regions where severe storms may occur during the birds' breeding season.

The globular type of nest provides concealment for the contents, including the brooding bird. Bowl-shaped nests on branches, especially in the tropics, are usually well camouflaged as seen from the side but when viewed from above the eggs, chicks or brooding parent are apt to be much more conspicuous to predatory birds, arboreal mammals or snakes. Moreover, predators seem to find it more difficult to identify a nest as such if only a mass of vegetable material is visible. On leaving their floating nests grebes pull some of the sodden materials over the eggs, and predators never recognize these heaps in the water as nests. When chicks crane up in an open nest to receive food their movements are conspicuous but in a

covered nest these activities are concealed. Even when domed nests are on the ground the movements of the parents may be very inconspicuous if the nest is in thick vegetation, as the parents are not outlined against the sky, and birds hopping about close to the ground may appear to be feeding. At least some mammalian and reptilian nest-predators discover nests by noticing movements rather than by spotting the structures.

Thus there is good reason to believe that covered nests are specially useful in foiling predators and that this is their main function in the tropics. Although a covered fabric nest is more vulnerable than a cavity nest in a tree, with an entrance admitting only small creatures, it gives better protection, other things being equal, than an open nest. Covered nests also are often designed in such a way that it is difficult for a predator approaching the entrance to trap the parent bird when escaping. Wrens' nests have overhanging eaves so that the sitting bird can fly out downwards, several tropical species of swallow construct a long tubular entrance, rendering it impossible for a small marauder to creep in un-awares, and African Penduline Tits construct bag nests with the real entrance well concealed and a conspicuous false entrance below.

It will be apparent, I hope, from this discussion of the forms of some nests, that the study of birds' nests is not only an interesting hobby but of scientific importance. Many other aspects of the subject are well worth attention: for example, the modifications in the structure of the nest and the birds' behavior when normal nesting materials are not available. The nests of Baltimore Orioles used to contain a quantity of horsehair but now that farms are mechanized the birds use fibres of various kinds — as they must have done before the horse was brought to the New World. The differences in the kinds of material used by closely related species to line the nest are also deserving of attention. Very little is known concerning such matters as whether birds tend to reject vividly colored feathers when lining their nests. Here, in the study of all aspects of the positioning, building, structure and lining of birds' nests, is an aspect of ornithology which should appeal specially to the amateur who likes to spend his leisure in the open and still retain the hunter's delight in finding a bird's nest.

News from the Conservation Foundation

The Human Fertility Problem

The findings of two years of study by Dr. Richard Meier on the implications of fertility control were published in February in a book entitled "Modern Science and the Human Fertility Problem." The book was sponsored by The Foundation.

What is needed throughout the world is a cheap, effective, safe and natural method of controlling fertility, the book asserts, and Dr. Meier believes that science will soon make such a method available.

Alaskan Land Use Study

A contract has been signed between The Conservation Foundation and Hugh A. Johnson and Harold Jorgenson whereby The Foundation will underwrite the costs of an extensive land use survey in Alaska. The study is expected to provide needed background on Alaskan land resources and to help determine the selection of hundreds of thousands of acres for use. Another purpose is to "suggest some direction of thinking about the future management and use of Alaskan resources." A book based on the study will be published early next year.

Filmstrips Get Good Review

The Foundation's series of nine filmstrips in color titled "Demand, Supply and Balance" was released for distribution on March 16 and one of the first reviews comes from *Educational Screen*, a leading magazine in the field. Written by Irene Cypher, film critic of the magazine, it reads: "This is one of the most intriguing sets we have previewed in a long time and one with a host of possibilities to suggest for utilization . . . there should be some lively classroom discussions with the filmstrips; certainly there will not be mere passive viewing, and they offer much in the way of lesson-stimulating power." The Joint Council on Economic Education has already added its endorsement of the strips and a national distributor will be named soon.

Wildlife Conference

This year's North American Wildlife Conference was held in New York City in March and brought together some 2,000 persons concerned with economic, social and ecological aspects of wildlife. Samuel H. Ordway delivered a paper at the opening morning session on "Law and Progress in Conservation," and George Treichel, Dr. Frank Fraser Darling and Noel Simon participated in the sessions on African wildlife. For the first time a panel on pesticides research was included. Roger Hale was chairman of the concluding session at which Laurance Rockefeller delivered a paper on the program of the National Recreation Resources Review Committee, of which he is chairman. Dr. Osborn arranged a number of informal meetings on African wildlife problems.

Briefly Noted

Dr. Osborn addressed the opening banquet of the International Eugenics Conference at the Faculty Club of Columbia University on February 13, emphasizing certain aspects of world population growth. The conference was sponsored by the American Eugenics Society, Inc. . . . Members of the staff of The Conservation Foundation were judges in the Agriculture, Nature and Wildlife classes of the American Film Festival, put on by the Educational Film Library Association April 1-4. . . . Robert G. Snider has returned from the Sixth Bicentennial Planned Parenthood Conference at New Delhi. . . . News from Dick Cooley's very active "Research Center — Alaska Natural Resources" at Juneau indicates that projects are under way on Land and Resources Use, a study of Alaskan salmon and consideration of a study of native use of fish and game. . . . Government and industry officials alike complimented Roger Hale's realistic paper on "Pulpwood, Pesticides and People" delivered at the meeting of the American Pulpwood Association at the Waldorf-Astoria on February 25.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM
AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Myron Gordon 1899-1959

Dr. Myron Gordon, Geneticist of the New York Aquarium since 1947, died suddenly on March 12. He was 59 years old.

Many articles by Dr. Gordon have appeared in the Zoological Society's publications in the past 20 years, often following his return from an expedition to Central America where he had added another link to his chain of evidence concerning the evolution and genetics of the swordtails and platyfishes that were his special interest. His technical papers were less well known to the Society's Members, but among geneticists and ichthyologists — by whom he was considered the outstanding authority — they won for him an international reputation. For several years past his work on melanomas, or black cancers, of fishes was supported in large part by grants from the National Cancer Institute of the U. S. Public Health Service.

Dr. Gordon was a quiet and hard-working scientist who had contributed importantly to our knowledge of melanomas, and from whom a great deal more could have been expected. Science and his friends have lost much.

Flamingos of Four Species in Collection Now

Six species of Flamingos are known and our collection now contains the only four which have ever been exhibited. Now that April is here, they are on daily exhibition in the Flamingo Pool and anyone who remembers their pale colors of last fall before the new diet, containing carrot oil, began to take effect, will be astonished at the brilliance of the species that are highly colored in the wild.

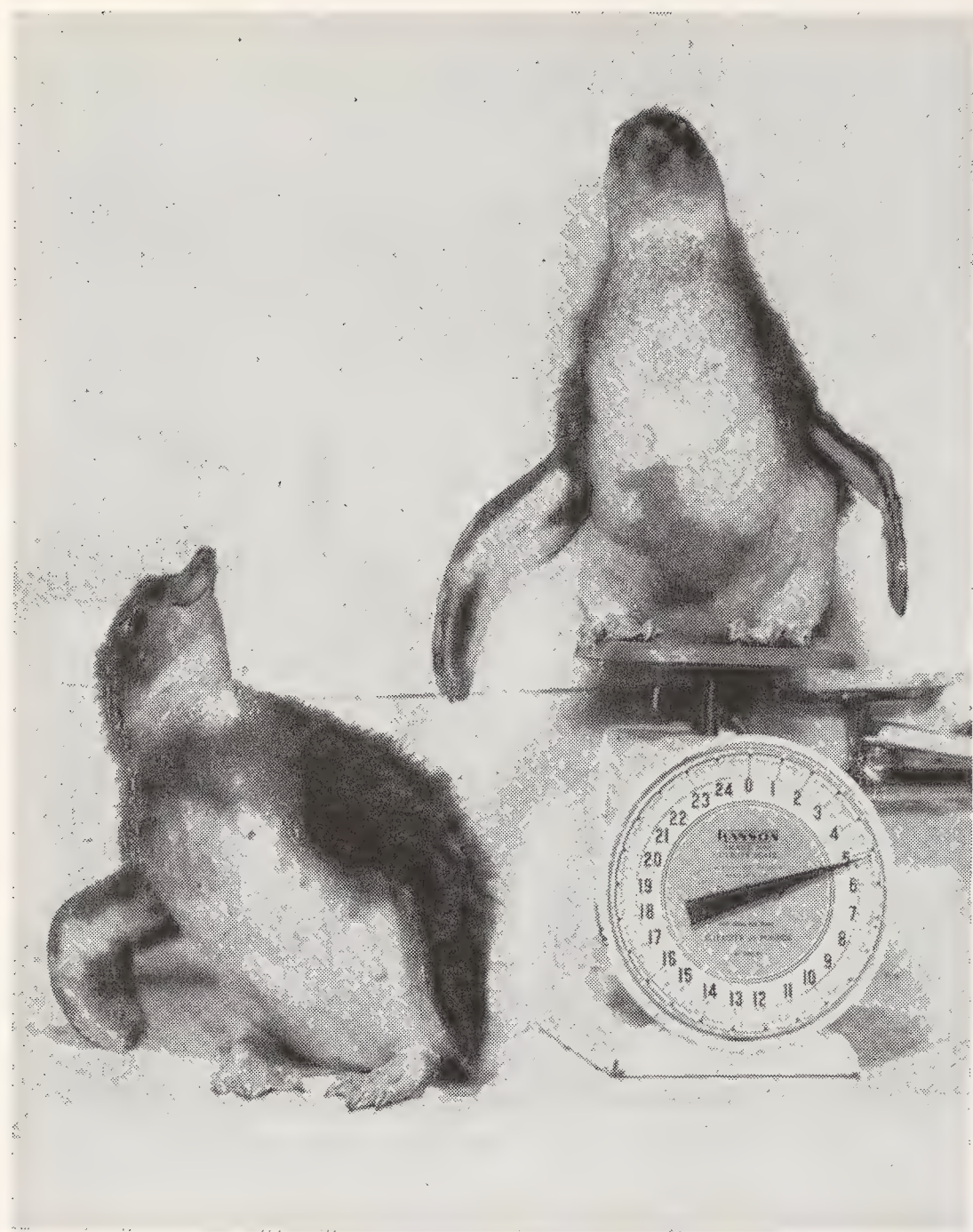
The two Flamingos we do not have are the Andean, *Phoenicoparrus andinus*, and the James's, *Phoenicoparrus jamesi*, from the high lakes of the Andes. No zoological park seems to have kept these two and thus far our own efforts to obtain them have been unsuccessful. The breeding grounds of James's Flamingo were rediscovered in 1957 after a period of half a century during which they were not observed and their very existence was doubted.

In the collection now are American Flamingos, *Phoenicopterus ruber*, ranging from the Bahamas through Cuba and Yucatan and northeastern South America with a small population on the Galapagos Islands (we have two young birds from the Galapagos); the Chilean, *Phoenicopterus chilensis*, from South America; the Greater, *Phoenicopterus antiquorum*, ranging from southern Europe to Africa and India; and the Lesser, *Phoenicopterus minor*, which ranges in Africa, Madagascar and India. We have 19 American Flamingos and two each of the other species.

Annie, a Celebrated Penguin, Killed by Vandals

Annie, the male Black-footed Penguin whose exploits have been recounted many times in newspapers and magazines, was killed on February 9. From the nature of his head injuries, he seems to have been felled by a rock as he guarded his two chicks on the bank of the out-of-doors Penguin Pool.

Annie came to the New York Aquarium in 1935 as an adult bird and was thus something more than 24 years old, a good age but not a record. Since penguins show no external sex differences, Annie was mis-named in the early days and it was not until many years later when he had acquired a mate that it was discovered that the supposed female was actually a male. In the early 1940s Annie and his mate nested and



Annie's Last Offspring

for 35 days incubated an egg that turned out to be infertile. When the fact became evident, newspaper articles and editorials expressed the public's disappointment.

After that first setback and the death of his first mate — at which time Annie's true sex was discovered — he mated again and has been the father of most of the 34 chicks hatched in the Penguin Pool.

The last offspring produced by Annie and his equally mis-named mate, Barney, were hatched on December 22-23. Barney showed little interest in them and they are being hand-reared in the Penguin House by Keeper Solanto.

IN BRIEF

Puff Adder Bonus. When we acquired a female Puff Adder from East Africa last year we felt that our Puff Adder needs were satisfied. However, in March the female gave birth to 37 healthy young adders and now we have the problem of finding food for them and homes in other zoological parks for most of them. The father, incidentally, is presumably a young male born in the collection three years ago.

It's Dr. Atz Now. Associate Curator James W. Atz of the Aquarium staff received the Ph.D. degree from New York University in February.

Cheetah Protocol. Cheetahs are, as a rule, easy to get along with — usually inoffensive toward their keepers and willing to make friends among themselves. Such has been the experience of a number of zoological parks, at any rate, but the young female in our collection has different ideas. When she was introduced to a young male two years ago, after a long period of "getting acquainted" through a barred door separating adjoining compartments in the Lion House, further weeks elapsed before she was willing to tolerate his presence in the same compartment. Eventually he died, and now we are going through the same process of cautious introduction. The new male, four years old, is much larger than the female, but she is not intimidated by the sight of him through the bars. She is still in the hissing and spitting stage and it may be several more weeks before the two animals can be left alone in the same compartment.

Garden Party Date. Wednesday, May 27, has been fixed as the date for the annual spring Garden Party at the Zoological Park for members of the Zoological Society and their friends. Detailed announcements will be sent to all Members well in advance.

Spring Openings. The Children's Zoo opened for its nineteenth season on March 28 and the Farm-in-the-Zoo on Saturday, April 4.

A Strange Disease. It has recently been found that the North American Angler, *Lophius americanus*, is subject to a strange disease that attacks the nervous system and causes extensive damage. The agent is a one-celled parasite that lives inside the cells of the cerebellum and other parts of the nervous system. The remarkable thing is that the fish survive and eventually regenerate many of their injured nerve cells — a fact that has caused great interest among neurologists. Drs. Nigrelli and Jakowska at the Aquarium's laboratory have examined more than a hundred of the fish and Dr. Jakowska has been making biochemical analyses of the diseased and healthy tissues in an effort to find out what is going on.

PUBLICATIONS OF INTEREST

WILD TIGERS AND TAME FLEAS. By Bill Ballantine. 344 pp., many black-and-white illus. by the author. Rinehart & Co., New York, 1958. \$5.00.

Thirteen anecdotal chapters about animal trainers, Big Top and flea circuses, zoo animal acts, snake charmers — all the more flamboyant manifestations of the wild animal business. Delightfully written by a man who knows circus life from the inside.

WHOOPIING CRANE. By Robert M. McClung. Illustrated by Lloyd Sandford. 63 pp. William Morrow & Co., New York, 1959. \$2.50.

Another fine addition to the series of children's books by Mr. McClung. This is an exciting and accurate

natural history story of one of our rarest American birds and will prove as instructive as it is interesting to the young reader. The layout is greatly enhanced by the fine black and white illustrations from the brush of the Zoological Park's staff artist, Lloyd Sandford. — DR.

NATURE STORIES FROM THE VIENNA WOODS. By Lilli Koenig. Foreword by Konrad Lorenz. Translated by Marjorie Latzke. 159 pp., many photographs and drawings. Thomas Y. Crowell Co., New York, 1959. \$3.50.

After the last war Otto and Lilli Koenig and five other young biologists established an animal behavior research station at Wilhelminenberg outside Vienna. These "Nature Stories" are charmingly human — but not anthropomorphic — accounts of some of the birds and mammals under observation.

New Members of the New York Zoological Society (Between January 1 and February 28, 1959)

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Associate Founder

Mrs. Paul Moore
Robert Thompson

Patron

De Witt Wallace

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Announcing...

TWO CAMERA SAFARIS IN THE BRONX ZOO

The mornings of SATURDAY, APRIL 25

SATURDAY, JUNE 20

Here's a chance for Members with cameras—from Brownies to Leicas—to practice the art of animal photography under the genial and astute guidance of those two outstanding professionals, Staff Photographer Sam Dunton and the Society's Photographic Consultant Henry M. Lester.

Tours are limited to Members only (one person from a Member's family) and will be held rain or shine.

Starting time is 10:30 at the Members' Room in the Administration Building. Tours end at 12:30.

Members planning to attend should send in the attached postcard promptly.

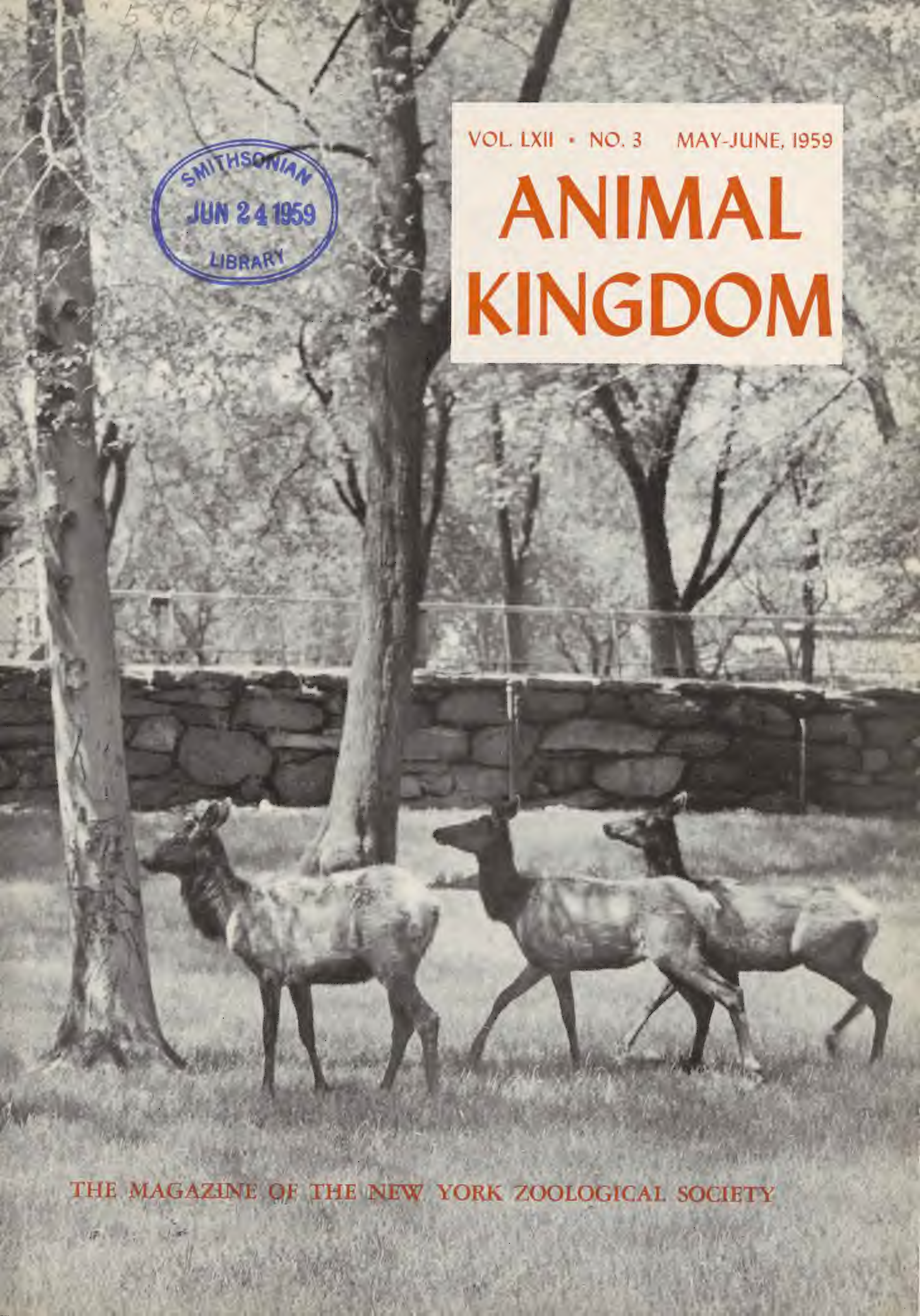
Whether you are a professional or an amateur, these tours will be rewarding.





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ANIMAL KINGDOM



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ANIMAL KINGDOM

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The Best Thing

New York City Has

THERE HAS ALWAYS BEEN plenty of reason to consider the Bronx Zoo as a "Mecca for all people from everywhere." First, it is obviously a key center of interest and enjoyment for the people of New York for whose benefit it was created and has been maintained throughout the 60 years of its existence.

In addition to what the Zoo means to New Yorkers, it is a magnet for visitors from all over our country and, indeed, to people from all over the world. It is a pity that, somehow or other, a recording system could not have been devised to tell us with accuracy how many people from how many foreign countries have come to the Zoo over the years. There is little question that visitors from virtually every country in the world have at one time or another visited the Zoo. Within our wonderfully diversified collections of animals from every region of the earth they are bound to find species that are typical of their "home country," which is perhaps one reason for their coming.

Only recently New York was visited by some people from other countries, who happened to be much in the public eye during their stay here — Fidel Castro, the revolutionary leader and his staff from Cuba, and the Bolshoi Ballet from the Soviet Union. Though these foreign visitors came from such widely different backgrounds, it was no surprise that both groups came to the Zoo at the first possible moment, spending many hours there. While we could not understand the ejaculations of evident pleasure of the members of the ballet troupe, Fidel Castro summarized his view by a remark that was widely quoted in the press. He said, "The Bronx Zoo is the best thing New York City has." Although not competent to judge his views on other matters, we can easily be persuaded to go along with him on his opinion as to the place the Zoo holds in the affections of the public.

Fairfield Osborn

SMITHSONIAN JUN 22 1959
INSTITUTION

The Mossy-throated Bellbird



an Ornithological Mystery

by WILLIAM G. CONWAY

IN TRINIDAD, on the 31st of March, 1954, William Beebe recorded the first nest of any species of bellbird that had ever been found. It was a flimsy platform, like a pigeon nest, of interlocking Y-shaped twigs and belonged to the Mossy-throated Bellbird. That the nest of this species should be the first reported among the four species of bellbirds was strange in itself, for the Mossy-throat is the least-known member of the whole strange group. The Bare-throated Bellbird from southeast Brazil has been commonly kept in zoos and may usually be seen in our collection. The London Zoo has exhibited the White or One-wattled Bellbird from the Guianas and northern Brazil, and the grotesque Three-wattled Bellbird from Nicaragua, Costa Rica and Panama was captured by Charles Cordier during the New York Zoological Society's 1947 expedition. Lee Crandall described its strange calling posture in *Zoologica* in 1948. But the Mossy-throated Bellbird had never been captured alive and, beyond Dr. Beebe's nest observations and a subsequent note by Dr. Wilbur Downs who found a nest with an egg, its habits are little better known than they were 142 years ago when the species was described by Cuvier.

With such an ornithological mystery waiting to be solved, it was inevitable, when I began making preparations for a visit to Dr. Beebe at Simla, the Trinidad Field Station of the Tropical Research Department, that the Zoological Park's staff strongly urged me to at least *try* to bring back a Mossy-throated Bellbird. It was difficult not to become superstitious about the bird. Trapping a small collection of birds in Trinidad's northern mountain range was certainly an objective of the trip, and tanagers, honeycreepers, even manakins, were planned for with some confidence. I hinted at woodpeckers and openly hoped for Jacamars, never exhibited alive in the United States, but there is something special about a "Mossy-throated" Bellbird. Its nearest kin may be cocks-of-the-rock and umbrella birds, the fruit-crows and calf birds, but its queer name and the few old drawings available — for it had not even been photographed alive — seemed to place it in another and more fanciful class — perhaps with Hairy Frogs and Platypuses. It is not a large bird, but smaller than a pigeon, though larger than a robin. Its body is a light silvery gray, just off white, and its wings are black. It wears a cap of chestnut feathers and is, to this point, attractive

Left. — The fleshy "moss" varies in length from an eighth of an inch to about two inches. Apparently it is not extensible, but more observation will be necessary before we are sure. Right. — Mossy-throated Bellbirds live in this lower montane rain forest in Trinidad and may be heard calling all the time during the day. The trees are very high and the birds usually stay high, too.



but not especially prepossessing. However, should *Procnias averano carnobarba* turn to face us, any picture we may possibly have formed will be effaced from our minds by the sight of a bird with a long, dense, bushy black beard: not a beard of feathers, or even hair, but *carnobarba* — a fleshy beard! Composed of myriad soft, pliable, slightly string-like wattles, the beard cannot be erected and from our observations is not swollen or extended during courtship. The wattles are not connected with any internal organ, but are a skin specialization and, so far as we know, as Dr. Beebe has noted, “serve only to enhance our ignorance.” Obviously, anyone who intended to trap birds in Trinidad could not entirely ignore the Mossy-throated Bellbird.

The ways in which wild birds may be collected are limited only by the ingenuity of the collector and, of course, the habits of the birds. Few of the birds in our collection are captive-bred, though waterfowl and pheasants are notable exceptions to this rule. By and large, when we view a Long-wattled Umbrella Bird, whose exhibition label reads “Andes Mountains of Ecuador,” or a Scarlet-tufted Malachite Sunbird, “Mt. Kenya and Mt. Kilimanjaro,” we may usually surmise that someone actually went into these far-off areas and devised some method of obtaining birds. An old, sometimes very useful, trapping method is the use of a sticky substance called bird lime, which acts almost like flypaper and holds birds at the perches they frequent. All sorts of specially constructed funnel or maze traps have been devised and various triggered traps have also been developed. Today a net which may be fired over a flock of feeding geese is being used extensively by various wild life agencies for banding and other research purposes. As my visit to Simla could not be a long one, I wished to keep equipment at a minimum and decided to confine myself to “mist nets,” widely used by American bird banders. Shipping boxes, miscellaneous pans and certain other special impedimenta were dispatched via Alcoa’s steamship *Ferncape*, but the nets and a few other items I carried myself.

The first few days at Simla were spent in orientation. Dr. Beebe provided a wealth of important background information, and Jocelyn Crane swiftly prepared to aid the insistent demands of a bird collection. A base such as Simla,

with the wonderfully organized help of a group of veteran tropical naturalists led by Will Beebe, entirely dispelled the difficulties anticipated on a jungle trip. Entomologist Henry Fleming and Resident Naturalist David Snow guided me to several likely collecting spots, and a series of trips was gradually outlined.

On Good Friday morning, Peter, a local boy magically provided by Simla, helped me load an automobile with bird crates, mist nets, binoculars, string, hummingbird vials, camera and special aluminum poles for a trip to a manakin bathing area which David Snow had pointed out. Each afternoon between 2:00 and 5:00, at certain pools along a deeply shaded tropical stream which flows down the east side of the Arima Valley to the river below Simla, manakins of two species gather to preen and bathe. During a previous trip to the area I noticed which perches the birds used to approach the pools, and now I hoped to use that knowledge.

Peter and I were able to drive within a mile of the trapping site, where we unloaded the car to clamber down the steep bank of the river with our equipment and waded through the shallow water below pipe-organ-like bamboos to a narrow trail. The trail, or trace, as it is called, was littered with tiny pieces of leaves dropped by leaf-cutting ants and we followed these casual markers until we came to a narrow stream. From here on the going became treacherous and we waded up the stream over rounded, slippery rocks, carefully avoiding spiny palm trunks and pushing through lush growths of fleshy-leaved ground plants. Climbing through the undergrowth I was able to forget this truly beautiful setting to think back on Jim Oliver’s tales of *Fer-de-lance* and *Bushmasters* — and his parting gift, a snake-bite kit.

Eventually a clearing appeared and here, carefully plotting the manakin flyways, we set up our telescoping aluminum poles. Actually designed for tree pruning, these hollow tubes may be extended to nearly 30 feet or may be slipped down to a little over six. They enabled us to stand on the banks of the stream and raise our mist nets to the level of low trees around us where birds were likely to fly. The nets themselves consist of black silk or nylon $\frac{3}{4}$ -inch mesh made up in thirty-foot lengths eight feet wide. At top and

bottom and at three places through the belly of the net run three silk cords and the net is stretched with its greatest length parallel to the ground, in a vertical position, by the five attachment points at either end. The netting itself is allowed to droop loosely between the cord supports, forming folds in which birds may be entangled. We attached the first net to the poles and raised it high in the air and from only a few feet away the whole trap or "set" became invisible, for the silk mesh is little heavier than a hair net. A properly made set, where rays of sunlight do not reveal the mesh, like sparkling strands of spider gossamer, is so hard to bring in focus that I willingly admit to capturing myself while looking for the trap.

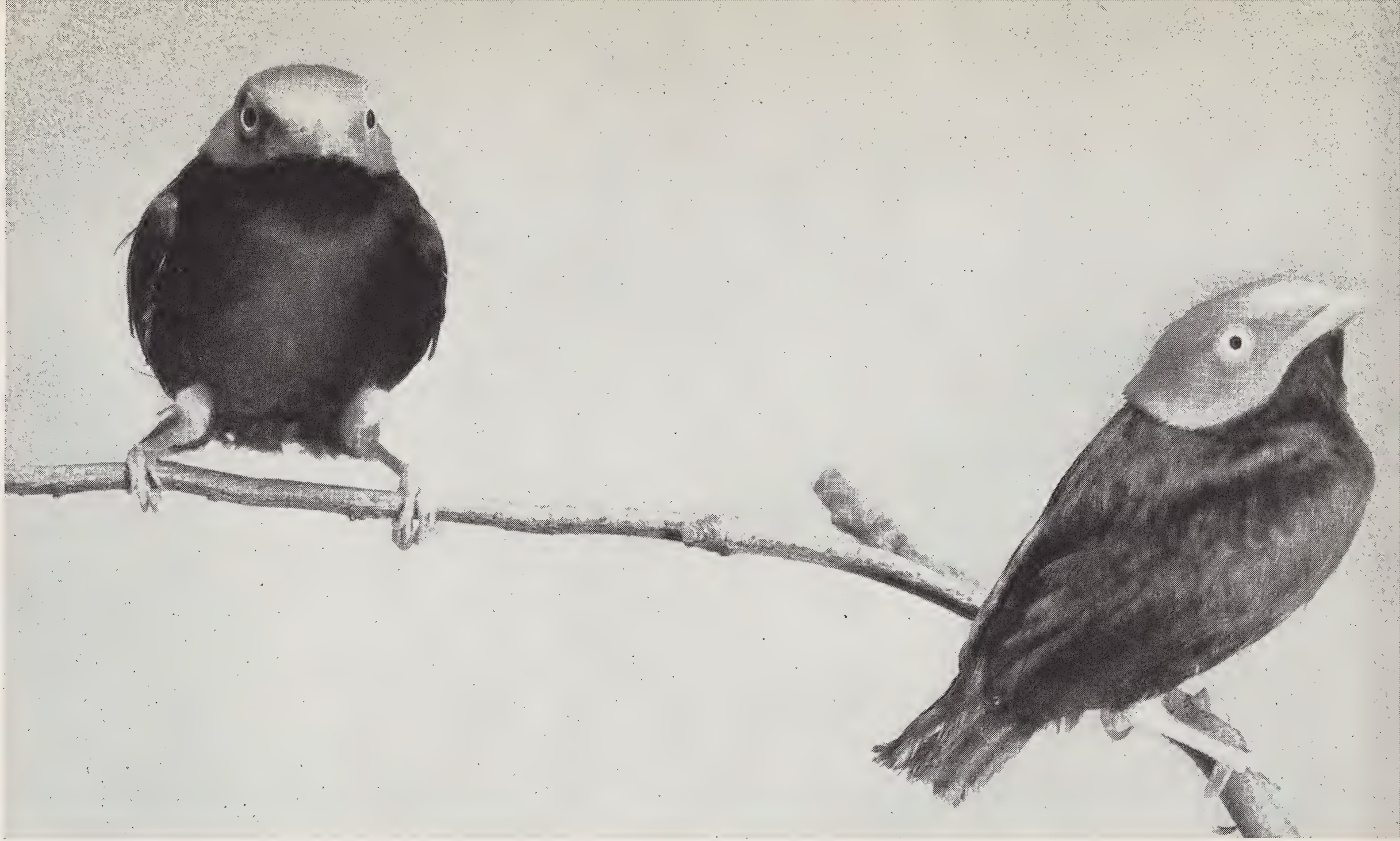
After the high set was completed with the aluminum poles, Peter and I began to tie more nets between trees as quickly as possible along the paths where we expected birds to appear. By the time we finished the third set, however, we had to drop all work to remove an Oily Flycatcher from the first net and a Black-and-white Manakin from the second. Erection of the fourth and fifth

nets was so constantly interrupted by captures that we dropped plans to place six nets and took down the fifth. Peter then took a stand behind a huge arum while I made myself comfortable on a rock in the center of the stream. We were soon running back and forth helping each other, releasing species we did not need, now and again herding some especially desirable bird through the undergrowth and shooing him into the nets. A pause came and we realized that rush hour was over and the noon lull had set in.

Most of all, on this trip, we wished to capture Golden-headed Manakins: wonderfully tiny, big-headed, short-tailed birds with carmine thighs, velvety black bodies and startling golden heads set with bright white eyes. Manakins are called "stick men" by Peter, referring to the habits of some species which display on a twig over a cleared courtship arena. Their fascinating habits are well entwined in Zoological Society history, for Dr. Beebe began studying them in 1908 and David Snow is concentrating on them now. Peter spotted a Golden-head flying from perch to perch near one of the nets. Finally, it flew directly towards the net, then veered sharply and slipped below it, and we realized we had both been holding our breath. Suddenly, a flash of gold and black hit the net on our right and manakin No. 1 was ours. I found I had achieved my first case of

Sunlight glints on the mist net, making its strands visible as Mr. Conway attaches a rope to one corner preparatory to pulling it up to the aerial pathway of the birds. The nets are 30 ft. long, 8 ft. high.





buck fever in a Trinidad jungle and my hands shook so badly that I slit the net to make sure the bird was not injured in removal. With a hissing rattle of specialized wing feathers, two Black-and-white Manakins fell into neat pockets in the lower tier of the high net and we telescoped the poles smoothly to remove them. As we raised the net again, an Emerald Hummingbird zoomed into the belly of the upper tier, but I left Peter to remove it, for I had noticed a Sabian Thrush in one of the low nets further up the stream.

Peter released the Emerald and came to help me with the thrush, which righteously bit my fingers as I put him through the indignities attendant on release. The thrush's right leg carried two yellow plastic bands, showing that it had been ringed by Dr. Snow in his studies at the St. Pat's Estate below Simla.

By 3:45 in the afternoon we had trapped nearly forty birds, of which we kept a number for the collection or photography. We dropped our nets and like two exhausted spiders began the tedious business of attempting to gather in nearly 1,200 square feet of silk mesh, with its incomparable ability to snag on every jungle twig and leaf. We were interrupted several times when birds lodged in the net even as we untied it, but we managed to begin the trek out at 5:00. Each crate of birds we darkened by a huge philodendron leaf.

On arrival at Simla, each bird was placed in a

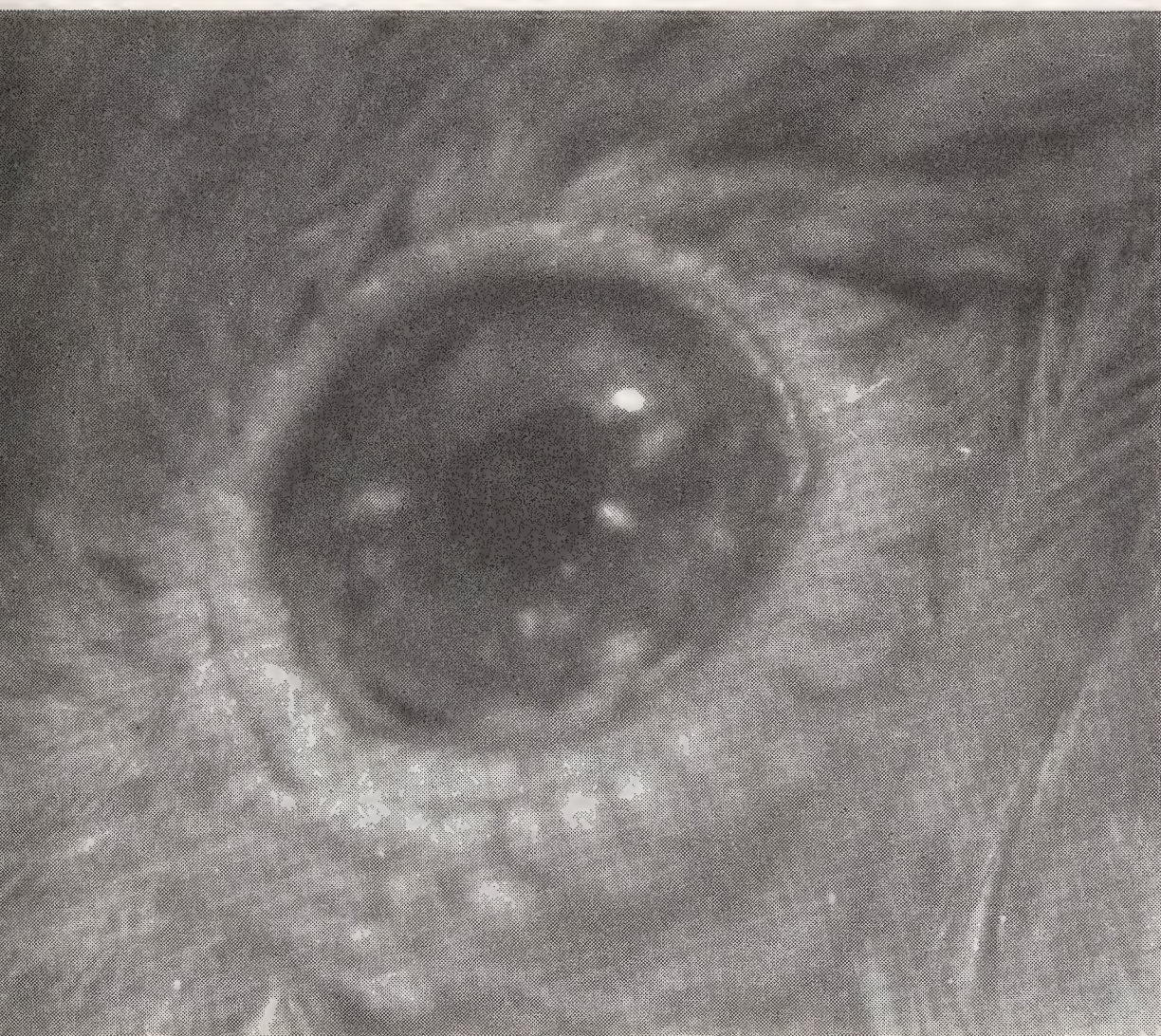
Above.—Two male Golden-headed Manakins were netted. They are a new subspecies to our collection. Right.—The iris of an immature male shows flecks of white. Adults have the iris completely white.

carefully masked separate compartment with its own food and water container. The following morning exact portions of fruit and mealworms were rationed out and each bird was carefully observed so that we might see which were not feeding and must be force-fed or released.

A number of devices were used to induce freshly captured specimens to feed, for many birds do not seem to recognize substitute food as being edible. Thus, the birds were enclosed in cages with solid backs, roofs and sides, and the fronts so covered that light entering the cage was focussed upon the food. This trick usually helps direct a bird's attention to unfamiliar foods such as oranges and canned cherries. Some birds plunge directly into their first captive courses with evident relish, but a few must be helped while their mouths are gently opened and especially delectable tidbits placed on their tongues or even pushed well down into their esophagus. Thus, a fine Green-backed Trogon (*Trogon s. strigilatus*), captured by Barbara Snow at the Snow's banding station, was force-fed, at some cost to our fingers, for four days before it began eating captive rations. Charles Cordier has related that he has found it necessary to force-feed some birds more

than 40 days to teach them to accept captive foods. All of us who have travelled in foreign lands where exotic foods confound the palate will appreciate the problem, but why some species or individuals accept substitute foods so much more readily than others is a very interesting problem. Of course, the foods we offer may be closer to the natural diets of some species than of others, but this is not the entire answer.

A fascinating side issue which took my interest lay in the minute white spots in the eyes of certain of the leaf-green "female" Golden-headed Manakins David Snow was banding, and to which he had called my attention. Zoo experience indicated that these birds might well be immature males. I was especially pleased, therefore, to trap a fine series that showed, as Will



Beebe was quick to note, a strange asymmetrical distribution of tiny eye spots in some birds, larger blotches in others, and, in one specimen, a complete ring of spots encircling the iris in one eye but only small spots in the other. Thus we had a fine developmental sequence before us, leading from the brown iris of the female or immature male to maturation of the adult male with his completely white irises.

A few days later Henry Fleming helped me load the car and we headed up the Arima Valley towards the pass over the Northern Range. At the pass, one may gaze south over the jungle-clothed mountains to the lowlands leading to Trinidad's Middle Range, or north towards the

West Indies and the Atlantic Ocean, and in this area we found a trail called Andrew's Trace. Following the trace past slender tree ferns below immense trees festooned with epiphytes, we came upon two small houses and noticed we were near a natural flyway: a low spot where birds wishing to cross the ridge came close to the ground, and whose attractiveness to birds was enhanced by a small stand of Guava trees laden with fruit. Several species of tanagers were feeding there, along with honeycreepers and bananaquits. Hummingbirds, incredibly abundant, zipped back and forth across the ridge, and the Tufted Coquette, most exotic of Trinidad hummingbirds, was among them. We realized what a find we had made, and raced back to the car to get a mist net and string it between the aluminum poles. Henry at one pole and I at the other, we trudged back to the flyway with the intention of forcing the poles into the soil on either side of the avian freeway. As we walked along, precisely thirty feet apart, with the net strung invisibly between us, I could not help but remember cartoons of glaziers in seemingly strange but oriented postures, carrying a long invisible pane of glass! At the proper place we stopped and found, to our consternation, that the soil was so hard we could not possibly force the poles into it, and as we struggled with this difficulty, a Red-headed Calliste, its brick red head resting upon a glossy coat of feathers so verdant it put the tropical foliage to shame, dropped easily into the net. We could not, of course, allow the nets to fall to the ground, yet we still had no way to support the poles so that we could remove the calliste, and we gazed at each other helplessly for a moment before the owner of the nearest house realized our predicament and came to our aid. As he held the pole I extracted the bird and raced back to the car to place it in a holding box. As I returned, I found another bird enmeshed, and thus we captured one tanager after another until we had as many as we could use. In addition, several manakins and hummingbirds were ensnared and released. Certainly, this was an example of the sort of good fortune which adds excitement to collecting, for the next day we captured not one single bird in the same area! The weather had changed and the Guava trees were depleted.

The Tufted Coquettes which we had noted earlier hit our nets on several occasions, but each time, after an almost imperceptible pause, flew on. These tiny hummingbirds, though wonderfully ornamented with great neck fans of elongated emerald green-tipped feathers, are so small they could pass right through the netting. This was the only area where we saw them frequently, and we knew we would have to catch one here or do without, so a few days later we made a set with two nets, one behind the other. In short order we captured two Hairy Hermit Hummingbirds and a Common Emerald, species we did not need for the collection. A Coquette was feeding nearby, and, as I watched, it flew directly to the nets and stopped so quickly that I could almost imagine the squeal of air brakes. It was a male, just what we hoped for, but it hovered, then darted over the net and disappeared. In the meantime I heard Peter calling. He had captured a Black-headed Honeycreeper and was having difficulty removing it from the net. When we returned to the hummingbird set I noticed a tiny leaf had blown into the middle tier and went to remove it. It was a magnificent male Tufted Coquette. I removed him from the net and plunged his beak into a vial of artificial nectar, but he would not drink, so I placed the tiny bill, not half an inch long, between my lips and sucked gently until I could feel his tongue protruding, then quickly replaced his beak in the nectar. He drank greedily and, like most hummingbirds, adapted wonderfully to his new surroundings when I placed him in a travelling cage.

During the first two weeks at Simla, not a bellbird was heard, although I was constantly assured they were common and "ought to be calling, but the season is very dry." David Snow had found some nestling Jacamars for us, which were growing wonderfully on a diet of mealworms, grasshoppers and katydids, and this relieved us of a part of our collecting schedule. So, borrowing Will's high-powered telescope, I stole off to peer about for the Mossy-throated Bellbird.

Driving along one road after another, to areas indicated by Will or Henry, I found the Bellbirds were calling. The powerful, immelodious *kokkk* followed by *kong kong kong kong kong kong kong* could be heard in several valleys, for it had finally rained, but nowhere were the



birds calling close to the road. At several places where a good view of the forest could be obtained from the high roads, I set up the telescope and scanned each and every top of the huge trees in the lower montane rain forest below me, to no avail. Although I could hear the birds well and tried to triangulate their positions from a series of points above them, they might as well have been leaves for all my searching. Toucans, caciques, screeching parrots and even darting hummingbirds could be seen, but no bellbirds. Furthermore, the areas where bellbirds seemed most common also appeared most impenetrable. Steep sheer banks dipped down into distant valleys with no trace or trail to follow. Finding, much less trapping, the birds under such conditions was out of the question. Henry Fleming had told me that bellbirds could often be heard calling along the Cumaca Road northeast of the little town of Valencia, and, eventually I made my way there. Driving, then listening, I found a point where the voices of seven separate birds could be distinguished, and through great good luck a faint trail led down from the mountain into the valley from which the voices emanated. Armed with binoculars, I took to the trail but

soon branched off on a faint path which seemed to lead directly into the center of the bellbirds' detonations. Soon I was close and could detect a new quality in the calls and actually feel the shock of each vibration, though I could not see the vocalists. Two were apparently near at hand and I struck out for the nearest, pushing through dracaena-like plants which threw thick leaves out in clusters perhaps three feet from the ground and were supported by improbably slender stalks. In the course of the next few hours it rained three times, so that the forest was saturated and a mist arose from the forest floor which added greatly to the beauty of the jungle and detracted not at all from the mystery which still surrounded the calling bellbirds. Amazingly, the birds had not paused in their calling throughout the thun-

derous downpours, and during momentary cessations in the rain I made hurried advances toward their sounds. Attempts to keep dry were abandoned as hopeless, but the temperature was so pleasant that the thorough soaking was not in the least uncomfortable. While the vegetation was wonderfully luxuriant, the ground cover under the huge Mora trees was not nearly so dense as that in many forests in the northeast United States. Then, too, it was not difficult to avoid occasional patches of razor grass or spiny palm trunks so that this jungle was a comfortable as well as fascinating place where one did not have to worry about poison ivy or battle nearly as many mosquitos as we would expect up north. Finally, I crossed a small stream and as each terrific vocal explosion pounded down upon me, realized I was directly under a bellbird, though I could not localize its source and in vain scanned the tree where I knew the bird must be. I covered one ear and moved off to one side then the other, attempting to fix the location more precisely, but the longer I listened the more difficult it became to detect the caller. At last a flash of silvery gray revealed the bird above me and a few minutes later it flew and I marked the way it went. The next bird proved easier to find, for instead of calling from a huge 100-foot Mora, it was using a slender Cecropia no more than 25 feet from the ground. I was uphill from the big cotinga, but after a slow and cautious stalk found myself within 35 feet of the bird. By 5:30 p.m. I had filled my field book with notes and sketches, knew the calling postures and display of the



The Tufted Coquette is the smallest and most ornate of the hummingbirds of Trinidad — smaller, indeed, than our native Ruby-throated. Many times Coquettes literally flew through the mesh of the net and finally a special set of two nets was rigged and this lovely male was captured. Its throat is an iridescent green.





Small but beautiful — a pair of Rufous-tailed Jacamars, distant relatives of woodpeckers. These are the first we have exhibited and it is probable that they are the first shown in North America.

Mossy-throated Bellbird, and had taken its first photograph alive — poor though the picture was because of the subdued light of the forest. Succeeding days filled out these observations but could not exceed the thrill of that first day, the first sight of the living bellbird and the pleasure of sharing with it alone the knowledge of how it displayed and called. Basically, the display calling and posturing was much like that of the Bare-throated Bellbird. Cocking the body tensely and twisting itself, with its long axis parallel to the perch, the Mossy-throated opens its huge mouth widely, then suddenly jumps or, sometimes, runs with vibrating wings up the perch opposite to the direction which it was originally facing. As it jumps and twists off the perch it emits the explosive *kokk!* Often, just after returning from a trip down the valley for food (we could surmise this, for it regurgitated large fruit seeds at intervals), the bird would perform one jump-twist after another between two branches perhaps three feet apart. At times the dance became almost manakin-like. At other times, the bellbird sat emitting the loud, explosive *kokkk*, then *kong*, *kong*, making no moves from an upright position. We soon learned that the birds were not confined to one calling perch, as had been previously supposed; in fact each bird observed had at least two, and of the four bellbirds we watched most closely, each had three favored perches. I had now decided to make a real trapping attempt and tied a long slender leaf to the base of each tree which held a calling perch. All the next day was spent watching the bellbirds, one specimen in particular which appeared to fly through the most accessible area. Soon our observations re-



vealed that it would disappear for as long as 45 minutes some time between 11:30 and 1:30 o'clock, that it always came back from the same direction, and usually flew to its calling perches from a flight line of a particular height between certain trees. I watched, and set imaginary nets. After I had seen the Mossy-throat fly into my fancied traps three times, I climbed back up the mountain to the car and returned to Simla.

The next day, in full collecting regalia and accompanied by Simla's Foreman, Sunny Ram

Lal, and Carpenter, Armstrong, as well as my helper Peter, carrying an aluminum extension ladder, I arrived at "Bellbird Valley" prepared to make a first trapping attempt. The lowest calling perch was within reach of our telescoping poles and here we set our first net, actually two nets, one above the other, so that we could not miss the bird should it change the inclination of its arrival flight.

Carrying the aluminum ladder down into the valley over the twisting slippery path had required real determination, but the ladder proved its value when it was erected at each of our



Every day a Mossy-throated Bellbird flew across the bed of this stream and here Mr. Conway sat quietly for hours, charting the flight path in preparation for putting up the net.

A light-weight metal ladder was of the greatest value when it came to attaching a net high on the trunk of a mora. Nets put up here finally resulted in the bellbird's capture.





Suddenly the bird reappeared on the scene. It flew to its highest calling perch and began to bombard us with its calls. From this branch, if our calculations were correct, it should fly to its low perch where two nets were stretched between the aluminum poles, and we should have a bellbird. However, should it, by some mischance, miss the nets in front of the low perch, it should still have to fly past three other sets across the paths to its other perches and its usual feeding route. A female appeared and the male gave chase, both headed directly to the low perch. At the last moment perhaps a ray of sunlight revealed the net or a breeze rippled it, for the male swooped under it and the female flew above it to land on the calling perch. We watched in a

A Mossy-throated Bellbird calling, high in a tree in the Trinidad forest. Mr. Conway took the picture, which is probably the first one ever made of a Mossy-throat in its habitat.

previously-marked trees, allowing Armstrong to drive and bend over thick nails into the bark of the trees at 50-foot heights. Strong cord was threaded through the bent nails to result in a flagpole-type arrangement which made it possible for us to attach our nets to the draw-cords and pull them from the ground high into the trees across the bellbird's flyways. We completed four sets by 11:30 a.m. Gathering tools and climbing equipment, we retired a safe distance from the nets, watched with binoculars and talked in low tones. Though all three of the crew had lived in Trinidad all their lives and had heard bellbirds as long as they could remember, each admitted he had never seen one at close range, and each had been taken aback by the grotesque appearance of the bird as it watched us from nearby branches while we worked on devices to trap it. For my part, I worried constantly that we might have frightened the bird so that it would not return, though it certainly seemed more curious than afraid. Armstrong related the local story that the bellbird or "Campañero" had argued with a blacksmith over which could deal the strongest blow to an anvil. The bellbird won and thus attained its voice! Actually, the voice of this species is not bell-like and the anvil-percussion simile is not a poor one.

positive agony of misgivings, wishing at one and the same time that we had placed the nets both lower and higher. Before we could begin "post mortems," however, the female flew out, away from all of our sets, and the male began calling. Then, as we watched, the male slipped off the perch and glided neatly through the ten-inch space between the upper and lower pole nets. We scarcely had time to feel disappointment when a fearful growling came from our highest tree net. We charged down the mountain side, brushing through razor grass as though it was eider down and leaping over fallen trees with a speed that would have done credit to a herd of Impala. Hanging neatly, but far from quietly, directly in the center of the net was the bellbird. Sunny and Armstrong raced to the pulleys and began a slow, cautious lowering of the net while I waited below. Spectacular though he had been when calling, nothing could compare with the appearance of the Mossy-throat in the hand. The sense of touch, for none of us could resist a gentle tweak of his magnificent beard, added the final dimension to our conception of the bird and increased our wonder over its countless unseen antecedents and their still inexplicable development of a "mossy" throat. It was only 1:30, barely two hours since the nets were first raised.

New and Lively —

THE MONKEY HOUSE

by WILLIAM BRIDGES



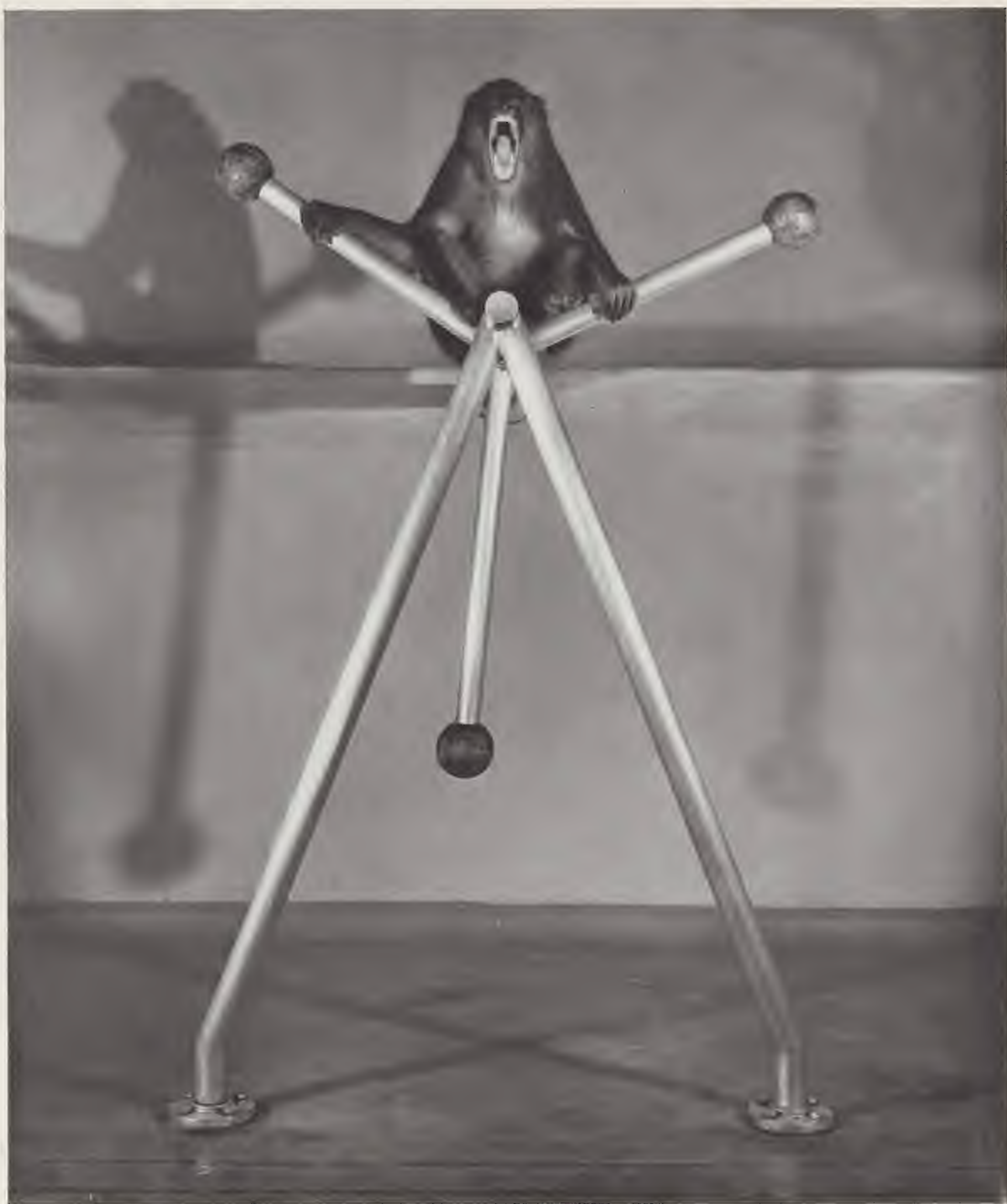
THE BRONX ZOO has a Monkey House again! After almost nine years of disuse, the old Primate House (built in 1901) has been entirely reconstructed except for its four walls, has been rechristened as the "Monkey House" and on Thursday, May 28, was opened to the public after a preview for Members of the Zoological Society on the previous day.

Inside the tile-lined, aluminum-railed hall are 20 compartments for 47 monkeys of 27 species — a fine and representative collection containing a number of rarities. Five additional outdoor compartments on the east side of the building will be in operation in another week or two. Eight of

the larger compartments are fronted with electrified glass that delivers a mild shock when touched (on the monkeys' side only) and acts as an efficient barrier for even the large and powerful Mandrills.

Gradually during the spring the monkeys have been introduced to their new home and all have been "in residence" long enough to become quite at home on the variety of climbing and exercise devices installed in their compartments.

The cost of reconstruction was \$350,000, paid by the Zoological Society. A new roof and floor were provided by the City at a cost of \$84,000. Edward Coe Embury was the architect.



MANDRILL

This face-splitting yawn is not a yawn of boredom, but a typical Mandrill gesture that makes the animal's armament of teeth apparent to all. About a tenth of a second after Staff Photographer Dunton took this photograph, the Mandrill sprang sideways onto the swinging arm of his perch and sent it spinning while he leaped to the floor of the compartment. The revolving arms of this play device were installed with some misgivings; if one of the two Mandrills in the compartment made the arms swing, might the other animal be struck by them? It was a needless worry. The female Mandrill seldom plays with the arms and stays well out of the way when the male gives them a whirl. He seems to find much pleasure in making them swing and has developed a polished routine of leaping on them at the most effective spot.



SPIDER MONKEYS

The principle of the wheel was presumably totally unknown to these Spider Monkeys in the wilds of their native South America, but this easily-turning aluminum wheel has become a source of great interest and enjoyment to the Spider Monkey group in one of the large central compartments in the new Monkey House. For the first few weeks after they were introduced to the wheel they were suspicious of it and its slow turning when one of them climbed on it made them leap to the floor or the ledge behind. But gradually they came to accept it and realize that it meant them no harm. Now they swarm over it all day long, hang from it by their tails, and occasionally one will allow himself to ride full circle. The best thing about it, from the Spiders' standpoint, is that there are plenty of secure tail-holds.



HAMLYN-L'HOEST HYBRID

Here's a rarity that is only a rarity by accident — a hybrid between a male Hamlyn's Monkey from tropical West Africa and a female l'Hoest's Monkey from the Belgian Congo. The youngster lacks the strong white streak on the nose that is characteristic of Hamlyn's.



BALD UAKARI

Photographs — despite the belief that the camera does not capture the full range of the Bald Uakari, for instance. It appears to be a creature that seems unnecessarily long and ready for use. In action, it is full of curiosity about the people, its movements, but always coming back to stare at the camera.



ARI

can nevertheless be misleading. Take this picture of a grinning animal, to say the least — and those teeth show that this is one of the most endearing little monkeys in my compartment, volatile, brisk and sudden in all its actions, and very popular with the people outside. We have two Red Uakaris, also.



SILVERED LEAF MONKEY

These are the first of the Silvered Leaf Monkeys we have had. They came from southern Sumatra and the nearby islands, and are fairly uncommon in collections. Our young pair has the advantage of being extremely lively and active and they have plenty of room to climb.

IGUANA ROUND-UP

By CHARLES M. BOGERT

THERE is a handsome young Green Iguana in the Bronx Zoo's Reptile House and I happen to know that some rather special arrangements have been made for its comfort. Periodically it is bathed in ultra violet light; it may bask at will in the warmth of infra red rays; even the floor of its compartment has a built-in temperature gradient that ranges from a cool 80 degrees at the back to a warm 100 degrees at the front.

These are more than amenities; they are almost necessities for this big tropical lizard. But they are not important to all lizards. In another compartment not far away, a Blue-tongued Skink flourishes with merely an overhead incandescent light and the slightest of temperature gradients in the floor. The skink basks on occasion, but unlike the Green Iguana, makes relatively little use of radiant heat to keep its body warmer than the surrounding air.

Practicalities of reptile management such as these are based both on experience and on research in the heat-regulating mechanisms of reptiles. We know *some* things, but there is so much more we would like to know.

For instance, why are the world's biggest lizards largely restricted to the tropics? Lizards lack the internal heating mechanisms of birds and mammals and their activities depend on heat absorbed from external sources — directly or indirectly from the sun. Thus, most lizards bask, at least on occasion. Through their behavior and pigmentary changes, many small lizards exercise astonishingly precise control over their body temperature.

Since size and shape obviously have some bearing on temperature control in lizards, it would be interesting to know whether it is their greater bulk that confines the larger species to the tropics. Furthermore, are these big lizards actually differ-

ent from the lizards of temperate climates in their heat requirements? What extremes of heat can they tolerate, and how important is behavior in regulating their heat intake?

After thinking about such matters a long time, I recently had the opportunity to find a few answers, by studies in the field. At least thirty specimens of a large lizard were needed and the Green Iguana, *Iguana iguana*, was the obvious choice among the lizards of the New World tropics. It reaches a maximum length of at least 5½ feet and a weight exceeding 13 pounds. It ranges northward along the Pacific coast slightly beyond the Tropic of Cancer, so it can be reached by one of Mexico's new highways.

Thus it was that on a propitiously clear morning a few months ago my wife and I found ourselves in the thorn-covered scrub near the settlement of Peñitas where the highway bridge crosses the San Pedro River some 750 miles below the border. Luck was with us. In the first half-hour I dropped a noose over a half-grown Green Iguana's head and after a considerable struggle pulled it out of the tree where it had been perched at a height of about 15 feet.

As the morning wore on we acquired sundry local helpers and by late afternoon some five or six iguanas were extracted from the dry, thorn-covered branches, evidently cut from trees in an adjacent clearing, that lined the river bank. But they were all juveniles and I could well recall that the first young ones I had ever seen were in similar surroundings along the Yeguaré River in Honduras. Adult iguanas spend most of their time in trees, although it is not unusual to see them on the ground. The same iguana is often seen in the same tree day after day, and it appears to be exceptional for an adult to move. Juveniles may venture into the larger trees, where they are not so easily seen. I am not sure whether

they restrict their foraging to the tangled undergrowth of roots and driftwood along river banks, but that is where I more often saw them.

If our investigation was to reveal why the truly large lizards are restricted to tropical environments, however, we needed larger iguanas than any thus far obtained. As we wound up our afternoon's work, therefore, I asked where we might find Green Iguanas of greater size. Our assistants pointed toward the foothills. They said large iguanas lived in the large willow trees growing along the river.

"*Muy bien*," I said, "I'll be back tomorrow, around ten o'clock in the morning. I'll meet you here. I will buy as many as you can obtain." There was not the slightest intimation that they expected to be paid for their efforts, but to offer more inducement I handed each of them some money, adding that I would pay five pesos for each iguana they caught. I did not realize it at the time, but five pesos was half the amount they usually received for a day's labor.

The following morning four men were awaiting our arrival and on the trail beside the now-drying river three boys joined us. The youngest of the three looked as though he might be too small to maintain the pace of the men and older boys. But, as we rapidly moved on toward the large

willows, I was astonished at his ability in climbing fences and jumping gullies. He was not so talkative as his companions, who called him "Tarasco" and informed me that he was seven years old. He promptly corrected them, saying that he was eight, and his name was Elmiro Corona. With four men and three boys we seemed well prepared to flush iguanas from the willows. Overhearing hasty conversations mentioning "*iguanas pintadas*" and "*cinco pesos*" when the men trailing behind us met friends along the way, however, we realized that iguana hunting was about to become a popular sport.

By the time we reached the first large tree, over a dozen assistants followed us, with Elmiro racing ahead like a bird dog. He paused just long enough to scan the branches of one tree before going on to the next. It was no great surprise when he yelled "Iguana!" and pointed, but I was astonished to find how difficult it was to see the lizard. I stared for several seconds, I am sure, before I could discern the large reptile. With its belly flush against a limb, the spines down the

This male Green Iguana has its throat fan fully distended while threatening another male. Several males often inhabit a single large tree.

All photographs by the author.





center of its back mingled with the twigs and leaves and the irregular bands of green and brown on the body blended with the background, almost completely obscuring the outline of the body.

Impressed by the iguana's camouflage, I was still staring when clods and sticks began to rain around the creature. Well protected by the foliage, however, it never budged. I feared at first that our helpers were trying to score a direct hit on the lizard, but it turned out that they were hoping to induce it to move down the limb, or to "jump" from the tree. One of the older boys tried to climb the trunk, but the first branches were some fifteen feet above ground and he abandoned his efforts. Then Elmiro appeared at the foot of the tree. Spreading his arms to hold himself in place while he dug his toes into the bark, he started his ascent of the trunk.

Our bird dog of a few minutes ago now seemed transformed into a measuring worm. Elmiro alternated his grip, and pushed as he dug into the bark with his toes or the sides of his *huaraches*. He made fair progress, despite the overabundance of encouragement and suggestions being shouted at him. Above the first limbs large enough to carry Elmiro's weight two large branches extended from the main trunk. The iguana was on one of these, but as Elmiro approached the branch, the lizard turned its head. Seemingly aware of impending attack from below, it began to shift its body, turned around and descended the branch with the utmost deliberation. When it reached the main trunk it started upward, moving fast enough to keep just beyond Elmiro's grasp.

Neither the lizard nor the boy moved rapidly, for each had to weave his body through the twigs and limbs that projected. But the iguana had the advantage in size, and from time to time it paused, waiting until Elmiro came closer before it resumed its retreat. The tree probably was not more than fifty feet high, but it began to sway in the breeze and plainly Elmiro entertained doubt that the branches would support him much longer. Above him the smaller limbs began to

Elmiro Corona holds a large female iguana he was instrumental in capturing. This lad was adept at climbing trees and flushing iguanas to the ground where they were usually caught.

bend under the weight of the iguana. Elmiro made a vain effort to reach its tail, but as he extended his hand the iguana abruptly dashed forward, on out beyond the limbs and into space.

As it landed splashing in the pool beneath the tree "all hell broke loose" but not quite in the manner described by Milton in *Paradise Lost*. Men and boys scrambled down the bank, laughing and shouting as they waded into the pool, or ran around one end to get on the other side. The iguana, propelling itself with its tail, swam toward the distant end of the pool, its head above the water. An older man waded out to intercept it, only to see it duck its head beneath the surface as it veered away from him. It reappeared, and the man splashed after it, frantically shouting "*Cinco pesos! Cinco pesos!*" He managed to seize the lizard by the tail, but by then the water was nearly three feet deep, and being unable to raise the lizard above the surface he quite needlessly became frightened and let go.

Again the lizard submerged, coming up near the bank where it scrambled out on land and took off in the tangle of vegetation growing between the pool and the bank. All of us now joined the chase, the poor iguana ducking in and out, wherever it could find an opening, and reversing or changing its direction every time we confronted it. I fully expected it to find a hole in the bank where it would disappear for good, but whether from exhaustion or confusion — at that juncture I could sympathize with it on either score — it ran close enough to one of the men, who dived forward and came up from the foliage with a firm grip on the middle of its tail.

Holding it at arm's length to avoid the stout claws, the triumphant captor came toward me, grinning as he asked, "*Vale más que cinco pesos? Es grande!*"

The iguana was an elegant example of his species, at least four and a half feet long, more brown than green, but with the gray color of the head conveying the impression that it was grizzled. The jowls sagged, seemingly protected by an enormous scale that stood out below the less conspicuous eardrum above the level of the mouth. Surmounting the crest of the body, the enormous reddish-brown spines were, understandably, bent in various directions, lending the lizard an air of profound disarray. Three spines pro-

jected from the snout, and the great dewlap suspended from the throat was edged with scales resembling teeth on a saw. Small wonder that dealers in the United States offer the bizarre creature for sale as a "Chinese dragon!"

Following our examination of the iguana, we placed it in a sack. I paid the captor five pesos and added a bonus. Then I rewarded Elmiro for his important contribution to the success of our endeavor. We continued along the river bank, repeating the general procedure as Elmiro induced one lizard after another to abandon its tree and take to the water or, in some instances, to the ground. Within less than a hundred yards we flushed seven large iguanas from the willow trees, but two made their getaway. One of them fled across the open river bed, disappearing into a thicket a hundred yards away on the opposite bank. The other one may have gone into a hole in the bank, or it could have been one of the two iguanas we found in the next tree. Once flushed, however, iguanas show little inclination to seek safety by returning to the tree tops.

This gave us a fair start in assembling the 30 iguanas we needed. In fact natives with iguanas already captured were waiting for us on subsequent trips from Tepic. Within a few days we had all the iguanas we dared try to transport. The larger individuals remained in the sack acquired earlier, but we placed the smaller ones in two baskets. With these on top of the load of what seemed like a ton of luggage, collecting and recording equipment, we headed for the San Diego Zoo in California. There the Curator of Reptiles, Mr. Charles E. Shaw, had generously indicated his willingness to allow us to house our iguanas in an open enclosure for further observation.

What had we thus far discovered about the heat requirements of Green Iguanas? In Nayarit their body temperatures during the latter part of February average 92.5° Fahrenheit, approximately the mean level maintained by small relatives of the iguana in the United States and Mexico. It was also evident that Green Iguanas bask, for their bodies invariably were warmer than air, sometimes exceeding air temperatures by 20 degrees. During the period of our work air temperatures near Peñitas, at our level — we could not actually record the temperature of the air near the iguanas — ranged from 73° to 93° F.,



The adult female Green Iguana is smaller and more graceful than the male, lacks his sagging jowls, and has proportionately smaller spines and dewlap. This one has lost her snout spines.

while bodies of the iguanas lay between 85° and 103.6° F.

In common with most arboreal animals, Green Iguanas spend the night in trees. Early one morning after we had spent a chilly night camped in the *marismas* in a fruitless effort to record the response of a *tigre* or jaguar to a "jaguar caller" employed by Mexican hunters, we observed an iguana high up in the branches of a gigantic *guanacaste*. It was probably the largest Green Iguana I ever saw, but we failed to catch it, anxious though I was to obtain its temperature. In our camp a mile away it could scarcely have been warmer and air temperatures there dropped to 48° F. Any self-respecting lizard in temperate climates would have sought cover, but this one almost certainly remained exposed to the chilly air, though perhaps hidden in the foliage.

So Green Iguanas remain abroad at temperatures that drive most smaller diurnal lizards to cover. They also seem unable to control the heat level of the body with the precision now demonstrated for smaller lizards. In the enclosure in the San Diego Zoo iguanas permitted their bodies to reach 108° F., but at other times they were active at 80° F. Could they withstand 115° F., the body temperature voluntarily tolerated by the Desert Iguana, *Dipsosaurus*, on rare occasions? To answer this question we took Green Iguanas to a warm area in Coachella Valley, at the edge of the Colorado Desert.

The day we carried out the tests air temperatures fluctuated between 103° and 108° F. We liberated iguanas in a large walled enclosure, with shade available less than ten feet away. By chance we began the first test with an iguana at the same temperature as our own, 98.6° F. Using a special thermometer, we recorded the lizard's temperature at intervals, finding that within 13 minutes its body had reached 115° F. At this level it began to pant, with its mouth open. Then it turned to face the sun and crawled a few feet toward the shade. We fully expected it to con-



The profile of an adult male is more bizarre. This picture shows part of the dewlap and the distinctive scale at the angle of the lower jaw. Here the spines on the snout are apparent.

tinue on its way, stopping only when it reached cover. Instead it remained where it had stopped in full sunlight, panting more furiously with the mouth opened wider, as the seconds ticked by. Thermometer readings revealed the value of the panting, or respiratory cooling, an automatic response to overheating in many animals but absent in some lizards already tested. Evaporation of moisture from the membranes of the mouth and lungs in this instance lowered the temperature slightly more than a degree within a two-minute interval. Of equal importance, there was no perceptible increase for three minutes.

The lizard still made no effort to escape the direct rays of the sun. Ten minutes after it started

to pant, erratic movements of the head marked the onset of heat rigor, with the muscles of the throat and chest becoming paralyzed as all signs of breathing stopped. Two minutes later no sign of life could be detected. The poor iguana exceeded the limits of endurance when it allowed its body to reach 116.6°F. , despite the easy accessibility of shade that could have saved it. Other Green Iguanas behaved in a similar fashion when exposed to nearly identical conditions.

Is it a matter of the iguana's stupidity? Not exactly. Behavioral responses, or patterns of behavior, are inherited, just as structural characteristics are inherited. Lizards inhabiting any region have been subjected to natural selection over countless generations. During millions of years they have become adapted for particular habitats, with selection affecting each population. Indirectly selection also affects the individual, each of which is endowed with the more obvious physical characteristics suiting it for survival. However, the interplay of environment and heredity implies something more. Each individual functions as an integrated whole. It follows that structure, physiology and behavior must be coordinated if they are to have survival value. The adaptation of any lizard to a wide range of environmental conditions would necessitate an interaction of behavior, size, shape, pigments and



Iguanas begin to pant when their body temperature approaches 115° . Rapid breathing with the mouth open carries off heat lost by evaporation from the moist air-passage lining.

other characteristics involved in the regulation of heat intake.

The Green Iguana is well adapted for survival in the forested lowlands or foothills where it lives. It is never subjected to temperatures below freezing or to the heat characterizing the middle latitude deserts in summer. Dry, arid conditions with hot summer weather prevail in Sonora 525 miles north of the areas known to be inhabited by Green Iguanas. Guaymas is roughly the southern limit of the Colorado Desert, and Green Iguanas may occur even closer, perhaps within 200 miles. Lizards described by an informant in such detail that they could scarcely have been anything but Green Iguanas, had been seen, he insisted, not far south of Alamos in the barranca region of southern Sonora.

This remains to be verified, but other reptiles largely restricted to the tropics do live in the barrancas north of the Tropic of Cancer, even when they are absent on the narrow coastal plain. Alamos approximates the southern limit for frost, and in regions farther south temperatures below freezing rarely if ever occur in the coastal lowlands and foothills. The coastal area receives less rain, and there may be a thermal belt in the moist barrancas where the huge lizard could survive. From what we know of the Green Iguana's habits and temperature tolerances, however, this would be the northernmost locality where it could be expected. A Green Iguana was inadvertently overlooked in the San Diego Zoo when others were moved indoors to protect them from a drop in temperature predicted for the night. It survived exposure to near freezing, if not freezing temperatures. Mr. Shaw found it the following morning, in a state of cold narcosis, hanging by one claw from the tree in which it had hidden. Prolonged exposure would surely have killed it.

In common with Galapagos Tortoises and probably many other large reptiles of the tropics, Green Iguanas lack behavioral responses suitable for survival in regions where they would be exposed to pronounced seasonal changes in temperature. Does bulk alone preclude their acquisition of suitable combinations of structure and behavior to allow them to compensate for seasonal changes outside the tropics? We cannot answer that question with certainty, but circumstantial evidence would suggest that it does.

The Long-Jawed Wrasse

A Fish with "Personality"

by JAMES W. ATZ



FISH FANCIERS often assert that each fish in a home aquarium behaves as an individual and has a personality all its own. Professional fishmen working in hatcheries, laboratories or public aquariums are inclined to regard this anthropomorphism with condescension or even contempt, but every so often a fish with such unusual behavior turns up in their collections that they, too, begin to talk about its human characteristics, give it a pet name and come to regard it from the sentimental amateur's point of view.

We recently received one of these unusual fishes at the Aquarium. It was not long before some of the newer tankmen were calling it

"Oscar," a whimsy that caused some of the older and more matter-of-fact tankmen to shake their heads — although as much in admiration of the fish as disapproval of their fellow workers. The fish had been received as part of an exchange with the Steinhart Aquarium of San Francisco. At first glance, it appeared out of place alongside the brightly colored parrot fishes, surgeon fishes and squirrel fish that had accompanied it on its airplane flight from the west coast. In fact, I wondered why Dr. Earl Herald, Curator of the Steinhart Aquarium, had chosen to send a species as dull-colored and nondescript as this one, but a closer look, for purposes of identification, re-

vealed an important peculiarity: the structure of its jaws, which are arranged in a fashion different from that of any other species of fish. At first we could appreciate this fact only in an academic way; not until later, when we saw the fish in action, could we fully understand how marvelous a mechanism it really is.

Reference books revealed that the scientific name of the fish is *Epibulus insidiator*; that it belongs to the large Family of wrasses but is the only member of its genus, being separated from all the other wrasses by virtue of its unique jaws; and that it inhabits a wide area of the Indo-Pacific, from Zanzibar and Mauritius east to the Riukius in the north and Australia in the south. Despite this wide distribution and the fact that it has been known to science for nearly two hundred years, nothing appears to have been recorded about its life history except that it reaches a length of at least 13 inches.

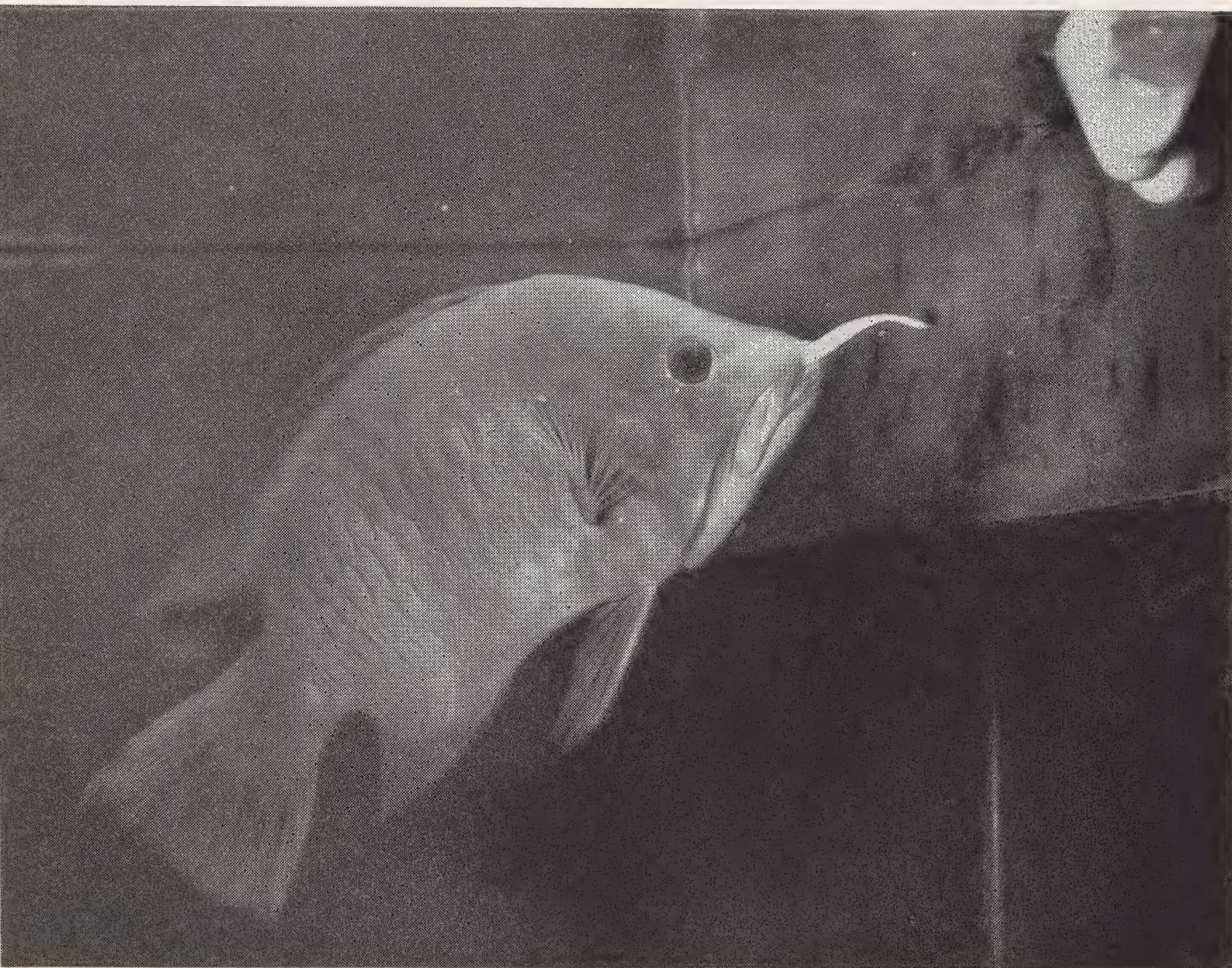
For some time our Long-jawed Wrasse (the appropriate popular name assigned to it by Dr. Herald) gave no indication of unusual behavior, either associated with the structure of its jaws or otherwise. It hid in a corner of its tank and responded to all attempts to coax it out by retiring even further, if possible. This is normal for a fish that has just suffered the stress and strain of half a day or more in a small, jostled plastic bag half filled with water and now finds itself

With lightning-like rapidity the Long-jawed Wrasse newly received at the Aquarium has snatched a piece of worm from the fingers of Tankman Dols. The camera caught it with its jaws half extended.

in a strange tank with conditions of temperature and water chemistry also inevitably changed from those to which it was accustomed. Nevertheless, we were concerned because our Long-jawed Wrasse was distinctly "hollow bellied," a sure sign of starvation. We tried several kinds of food to no avail and finally added some live brine shrimp to the tank. These tiny crustaceans seemed entirely too small for an eight-inch fish, but we have learned that it pays to try everything when enticing specimens to feed. In this case, the improbable proved to be the solution to our problem; the Long-jawed Wrasse started to eat — just a few brine shrimp at first, and then a small

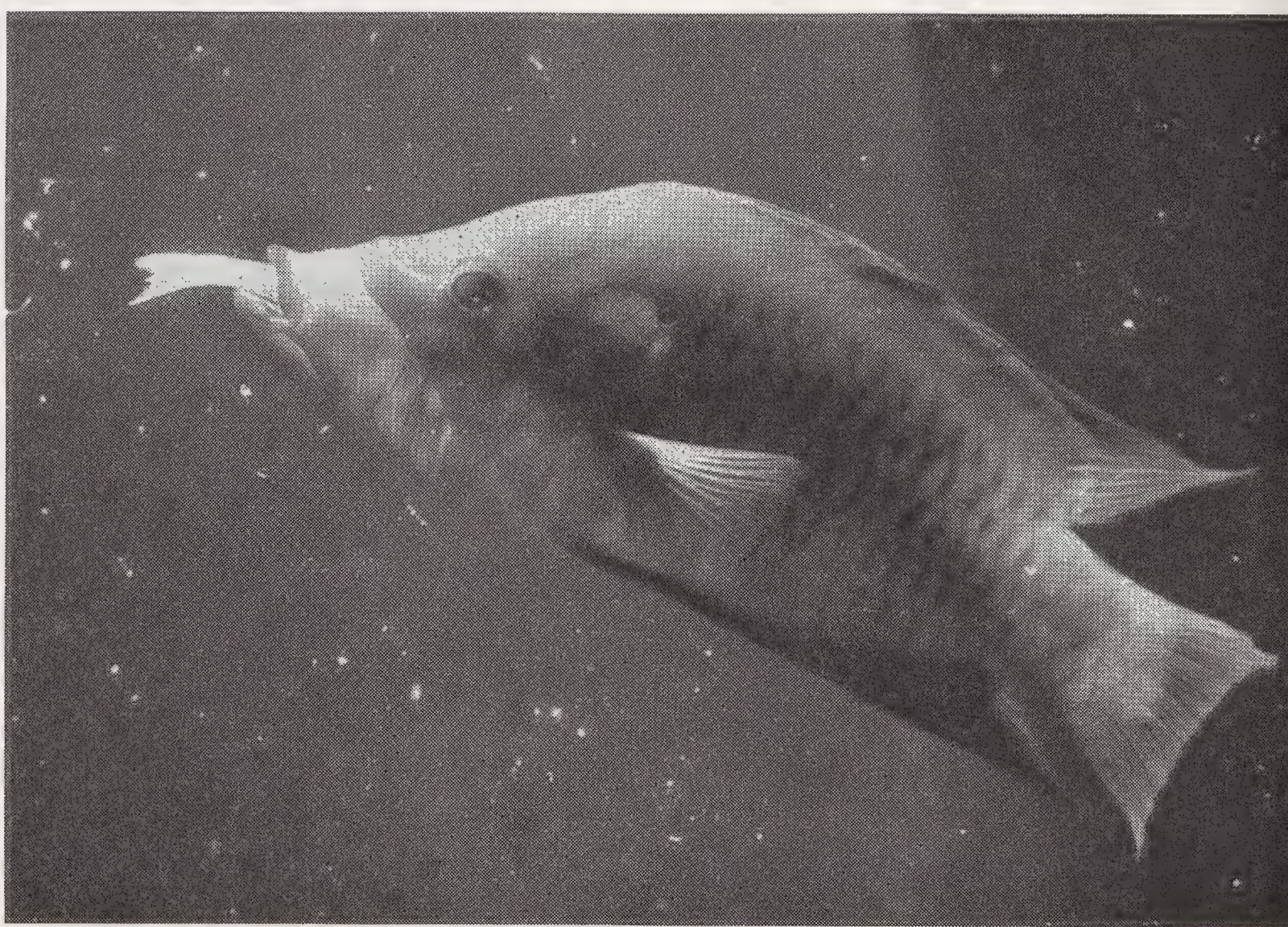
Guppy or two. As these tidbits stimulated its appetite, or it grew more at home in its new surroundings, the fish ate larger and larger prey until it was swallowing two-inch Swordtails and Killies without hesitation. Cockroaches thrown on the surface of the water were also snapped up with apparent gusto. Soon freshly-killed food, as well as living prey, was being taken, including bloodworms, earthworms, grass shrimp, whole Spearing and strips of clam.

Now it was that our Long-jawed Wrasse became the talk of the Aquarium. Everyone had to see it feed at least once, and the tankmen began to consider it their special pet. All of its former shyness gone, the fish spent most of its time in plain view near the surface of the water, frequently so near that it had to lie almost on its side. This in itself is not remarkable for a member of the wrasse Family — Hogfish, for example, do it regularly — but instead of diving toward the bottom when someone passed by the tank or flung an arm over the water, the Long-jawed Wrasse only backed up a bit, all the while ogling the intruder, usually first with one eye and then with the other. This alternation was made possible by a reversal of the side exposed to the surface, and between continuous flipping and simultaneous backing and filling, the fish gave a quite un-fishlike impression, strangely reminiscent of some four-footed animal begging for food. The effect of ogling was enhanced by the prominence of the eyes, which bulge distinctly, are ringed with a thin bright blue line, have an iris of burnished gold, and are extraordinarily mobile, moving up and down, forward and backward, undoubtedly in coordination with the fish's movements relative to the object it is viewing. A hand placed near the water was not the signal for a hasty retreat, as it would have been for most fish, but for a slow but deliberate approach. If a few fingers were immersed, these were carefully inspected from several angles to make certain they held no morsel. Tankmen Edward Dols and Charles Young, who were charged with the care of the specimen, were even able to touch it without causing undue alarm — a feat previously known to me only in fish that had undergone extensive periods of training. Small wonder that the fish was soon known by a pet name to all the tankmen. I have never seen any fish accommo-



Although it has a fish in its mouth, this rare wrasse carries its jaws in the retracted, resting position. No indication of their protrusible nature is apparent except the flap of skin extending from the lower jaw to the chest.

When it has taken a relatively large piece of food — in this instance a three-inch Killie — the Long-jawed Wrasse may hold it in its mouth for several minutes. The jaws are partly extended for most of this time. The protrusible part of the jaw is white.

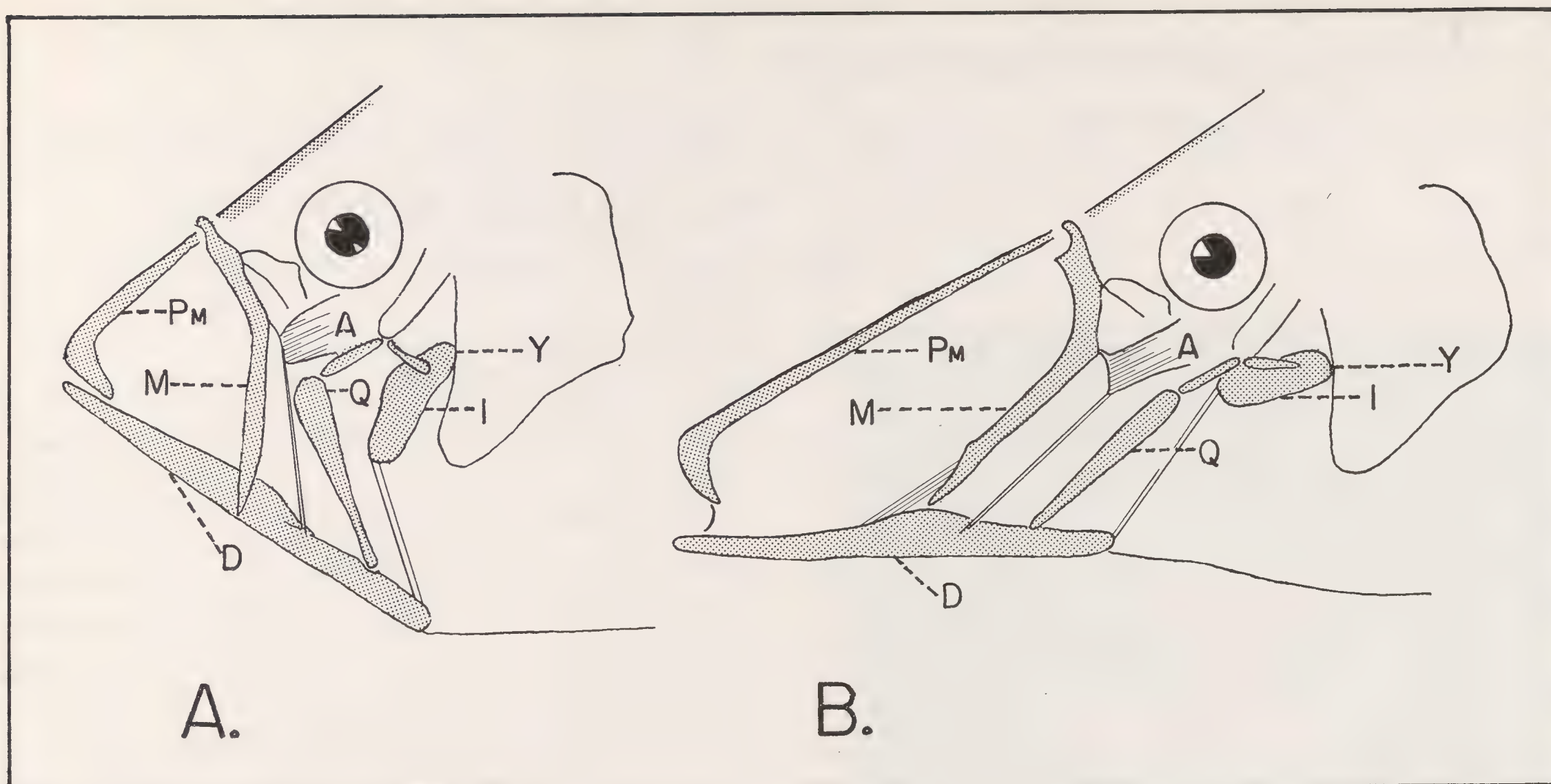


date itself to human beings as quickly as did our Long-jawed Wrasse.

We do not know whether this adaptability to captive life is characteristic of all *Epibulus insidiator* or represents an idiosyncrasy of our particular specimen. This is the first one we have ever had in our collections, and it was one of three brought to the Steinhart Aquarium from the south central Pacific, apparently the first three

Long-jawed Wrasses to reach the United States alive.

The fish's feeding habits are a continual source of surprise. This is the single aspect of the species that has been studied in any detail by ichthyologists. At rest, the mouth and jaws look quite ordinary except for a backward extension of the lower jaw that gives it a peculiar, underslung appearance. When a Long-jawed Wrasse spots



These drawings, after Van Dobben, show some of the mechanics of the Long-jawed Wrasse's jaw movements. Movable bones are shaded. By means of a series of muscles and bones (not shown here) the interopercular bone (I) is rotated in a clockwise direction about the point Y. Since this bone is attached to the lower jaw by a ligament, it pulls forward the dentary bone (D). Ligaments also connect the dentary to the premaxillary (Pm) and maxillary (M) so the upper jaw moves forward at the same time. The adductor muscle (A), which is attached to both maxillary and dentary, pulls the jaws back to resting position (Fig. A.). In most fishes the quadrate (Q) is not movable, but helps to form a fixed hinge for the lower jaw.

some prospective prey — and there is no doubt that vision plays by far the most important sensory role — it approaches, swimming by means of rowing motions of its pectoral fins and a fluttering of the rear part of its dorsal fin (a typical wrasse kind of locomotion). When still a good two inches away, it shoots out both its jaws, seizes the object, and before the startled observer realizes what has happened, has returned both jaws to the resting position. All the observer knows is that he saw a lightning-quick flash of white and that the food disappeared. Witnessing the performance several times helps very little; the fraction of a second it takes is simply too quick for the human eye. But sometimes, especially after eating, the Long-jawed Wrasse treats the observer to a leisurely yawn-like extension of its jaws, and then some idea of what is happening can be obtained. Full understanding, however, has required the study of dead specimens in which the complicated movements of bones and muscles could be analyzed step by step.*

The most remarkable feature of the anatomical

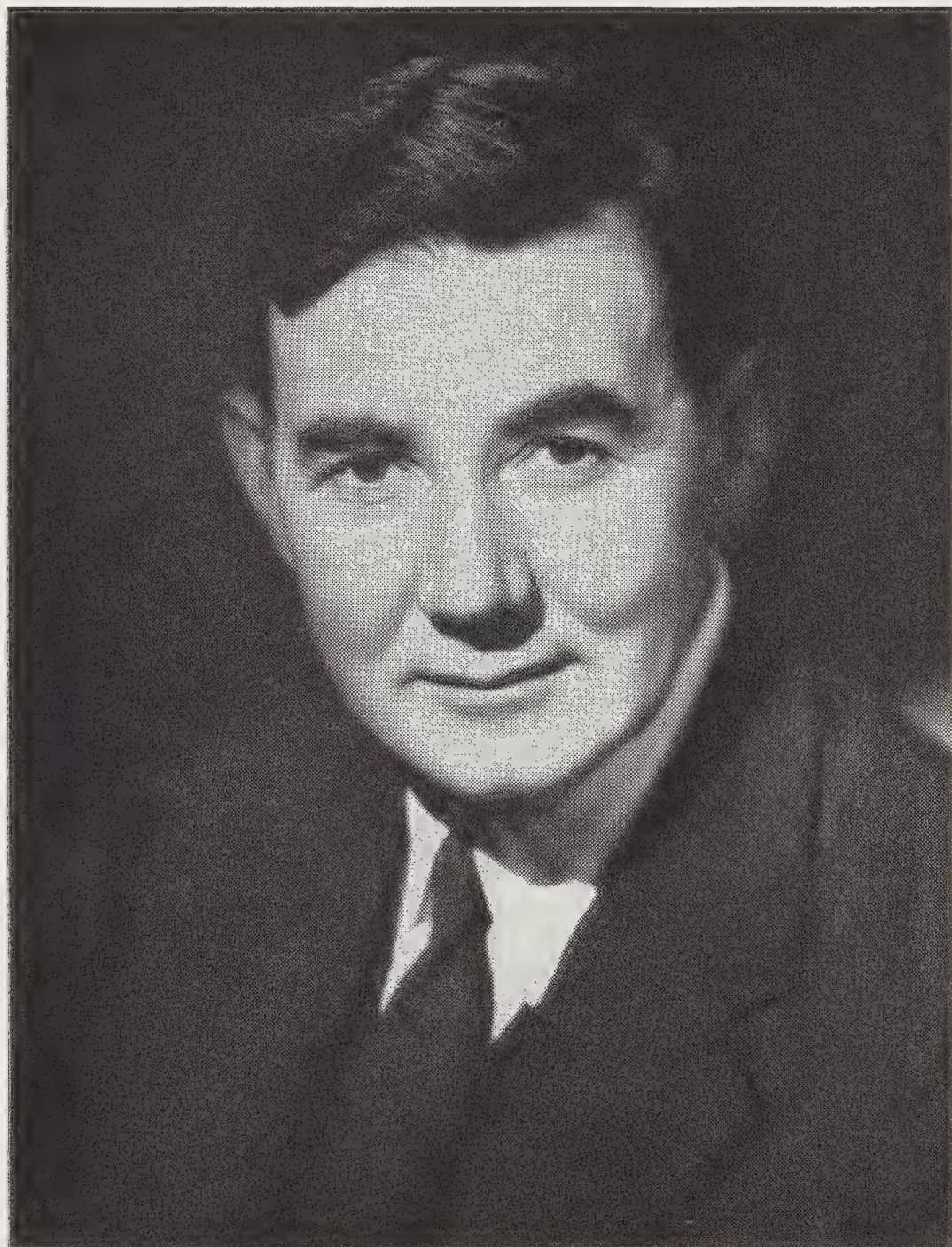
arrangement that makes possible this highly efficient way of catching prey is the separation of the lower jaw from the rest of the skull. In the vast majority of bony fishes, the lower jaw is firmly attached to the rear of the skull. Quite a number of species can protrude the upper jaw; very few, if any, beside the Long-jawed Wrasse can simultaneously protrude the lower. The key to the downward and forward motion of the lower jawbone (the *dentary*) is the clockwise rotation of the *interoperculum*. The *maxillary* and *premaxillary* of the upper jaw move forward passively as a result of their firm attachment to the lower jaw by ligaments.

It is hard to believe that the unusual general behavior of the Long-jawed Wrasse is not in some way associated with its unique feeding mechanism, but as yet no obvious connection has suggested itself. Nevertheless, to us the species seems especially fit, both anatomically and psychologically, to make its way in the world.

* Delsman, *Treubia*, 6: 98-106, 1925. Van Dobben, *Arch. Néerland. Zool.*, 2: 61-63, 1935.

CONSERVATION

FOUNDATION



F. Fraser Darling

Dr. Frank Fraser Darling has joined the staff of The Conservation Foundation as Vice-president and Director of Research. Dr. Darling is a formidable man. His publications include "West Highland Survey: A Study in Human Ecology," "Seasons and the Farmer," "History of Scottish Forests," "Wildlife Conservation," "Alaska — An Ecological Survey" (a Foundation project) and, more recently, "Pelican in the Wilderness," a description of his ecological observations in North America. He has recently completed two outstanding studies of the relationship of man to the flora and fauna of Northern Rhodesia and the Mara region of Africa.

A fellow of the Royal Society of Edinburgh, and holder of degrees of Doctor of Science and Doctor of Philosophy, Frank Darling will guide the continuing research work of The Foundation. This currently includes studies of population

pressures, crop yields, water usage, Alaskan development and the effects of chemical pesticides on the environment. He will also have opportunity to continue his own field studies of the causes and consequences of environmental changes of the United States, Africa and other parts of the world.

Animal Population Control

Dilemmas posed by use of pesticides for control of plant and animal populations are being set out in a new book sponsored by The Foundation for 1960 publication.

Prof. Robert Rudd of the University of California, a general zoologist with much practical experience in assessing the effects of pesticides on wildlife, is considering pesticides in relation to other natural controls of population numbers, such as "beneficial" forms of insects and mammal predators.

His book will demonstrate why pesticide use can be carried out successfully only after deep knowledge of living interrelationships of a particular environment, whether it be crop field, forest or tidal wash. The book is addressed chiefly to fellow scientists, executives of the chemical industry, agricultural workers, government administrators and others in the field.

Preview for Science Teachers

More than a hundred members of the Chemistry Teachers' Club and the Physics Club of New York gathered at a joint meeting at the Fieldston School May 2 and heard Martha Munzer of the Foundation's staff explain and demonstrate the filmstrip series "Demand, Supply and Balance."

Conducting simple classroom experiments closely relating to the filmstrips, Mrs. Munzer explained that the teaching of conservation had usually been left to the biology teacher. She went on to

point out that teachers of physics and chemistry, dealing as they do with the basic matter, have an unusual opportunity to lead their students to a better understanding of resource use problems and possible solutions.

This preview is one of several set up throughout the country to interest teachers in teaching science through conservation. Other meetings have been scheduled in Alpine, Texas; Los Angeles, California; and Portland, Oregon.

Briefly Noted

Wallace Bowman, who received his Master's Degree in Conservation at Yale and later studied under Stan Cain at the University of Michigan, has joined the staff as Assistant Director of Re-

search . . . Dr. Osborn made the principal address at the Centenary Banquet of the Quebec Wildlife Conservation Association on April 16 . . . Max Nicholson, director of Nature Conservancy of Great Britain, was a welcome visitor at the Foundation offices while in New York City in April-May . . . Steve Bergen, Assistant Director of Research, took an active part in the Cincinnati Water Pollution Conference sponsored by the U. S. Department of Health, April 20-24 . . . Roger Hale's report of the Berkeley Conference of Resource Management, complete with papers contributed and additional data, will be published by The Foundation in June . . . Fairfield Osborn conducted an April seminar on the subject of "World Population Food Supply" at the Institute of Nutritional Sciences, Columbia University . . .

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

"Free Lions" Offer Finally Finds Some Takers

The Lion market in the United States is fully saturated. The Mammal Department confirmed this as a fact in May when, after weeks of telephoning and letter-writing, it managed to dispose of four of the five adult Lions that have been exhibited on the African Plains since 1949. The

four went to small zoos in upstate New York and New Jersey and the fifth was retained for exhibition in the Lion House.

Five young Lions about a year old have replaced the adults on the African Plains exhibit.

No difficulty in disposing of the adults was foreseen when we started offering them to other zoological parks early in the spring. It turned out that everyone had plenty of Lions and instead

More than a hundred members of the Bolshoi Ballet made an excursion to the Bronx Zoo on Sunday, April 26, and appeared to enjoy every minute of a thorough tour. Earlier, on April 24, an unexpected but most enthusiastic visitor was Premier Fidel Castro of Cuba, who said the Zoo was "the best thing New York has."





Early in May a confused Robin began building a nest on the fire escape of the Administration Building in the Zoo. She started nests on ten different steps, finally concentrating on four and completing one. Three eggs were laid and all hatched. House Sparrows found the abandoned nests a wonderful source of choice building material for their nests in the area.

of welcoming our magnificent specimens, several zoos offered us *their* surplus Lions.

Lions breed readily in zoological parks and cubs are readily available. Being much more active than elderly adults, they are preferred by most zoos, and adults — however impressive in size — are quite literally a dime a dozen.

Penguin Film Wins Award

A certificate of award for excellence has been given to the Society's motion picture film in color, "Adelie Penguins of the Antarctic," at a national awards ceremony sponsored by Scholastic Teacher Magazine. The film was created from footage shot in the Antarctic by Dr. William J. L. Sladen.

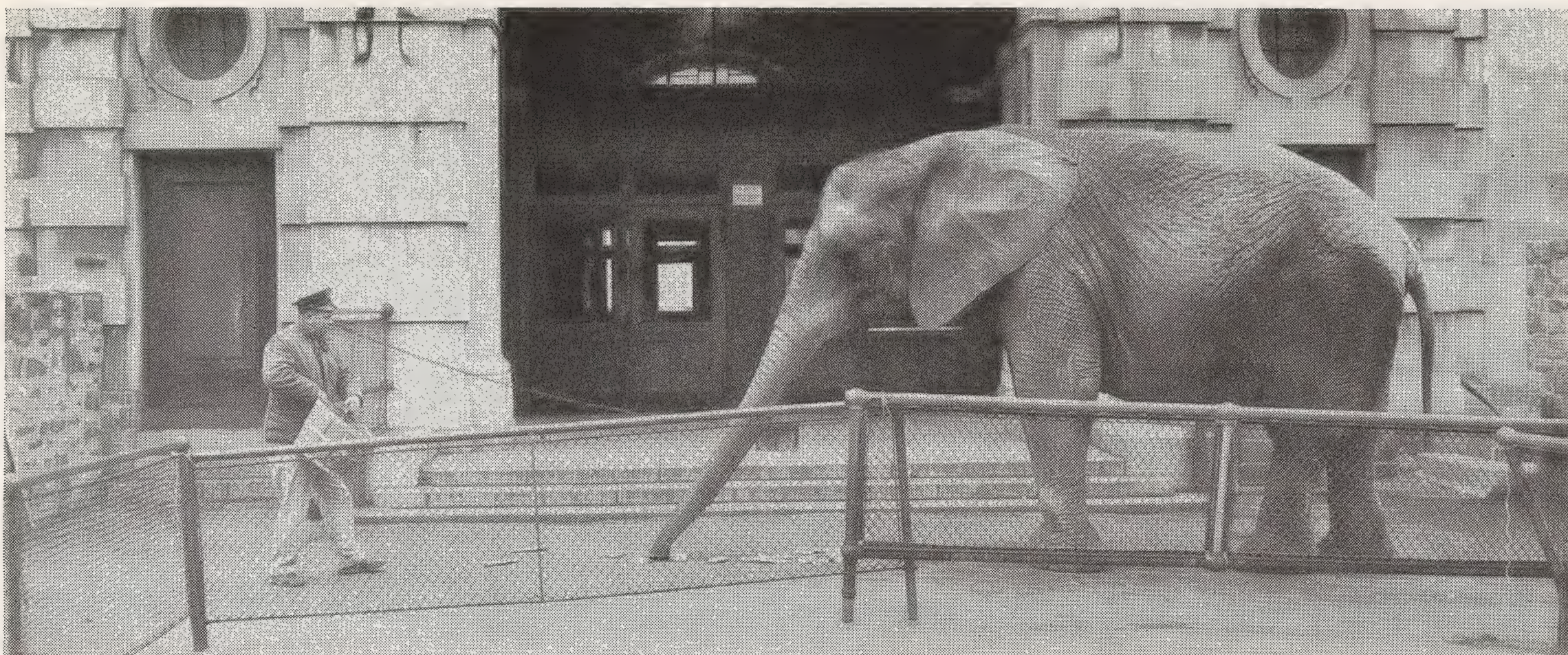
IN BRIEF

Bison Calf Born. There was a time, in the early years of the century and as late as the 1920s, when the birth of Bison calves in the collection was a commonplace. In later years our Bison herd has been reduced to merely one or two exhibition animals, and no calves have been born since 1934 — until May 26 when a bright rusty-red youngster was discovered with its mother in the Bison corral in the southeast corner of the Zoo. The mother is a new female, acquired early last winter, and was bred before coming to the Zoo.

Clean Great Apes. Shower baths delivering warm water have been installed in the Gorilla and Chimpanzee yards outside the Great Apes House and will run periodically during hot summer days. Mambo and Sumaili, the young Gorillas, were the first to get showers and were timid about the water for the first few days. Now they sit under it, splash and apparently enjoy their baths thoroughly.

New Pythons. Two Amethystine Pythons from Australia have been added to the Reptile House collection, the second time we have exhibited these big snakes which attain a length of about 20 feet. Our largest specimen is 13½ feet long.

Dr. Nigrelli to London. In mid-April Dr. Ross F. Nigrelli, the Aquarium's pathologist, gave a talk on the life span of fishes at the Ciba Foundation's fifth Colloquium on Aging in London.



“This far and no farther!” might well be Sudana’s motto, for the middle of the walk marked the limit of her courage for several days when we made repeated attempts to transfer her from her familiar yard at the east side of the Elephant House walk to the yard on the west side. For some years Sudana has shared the east yard with two Asiatic Elephants and recently it was decided to pair Sudana up with Pinky, another African Elephant on the west side. Baited with slices of bread, she was willing to go half-way but not all of the way — she ate all she could reach and then backed into her old yard. Patience won; she is now in her new home.

Bahamas Legislature Acts on New Exuma Cays Park

In January, 1958, the New York Zoological Society sponsored a survey of the Exuma Cays in the Bahamas (*Animal Kingdom*, March-April, 1958). This was to be the site of the first real land-and-sea park.

A little more than a year later, in March, 1959, the Bahamas Legislature passed the Bahamas National Trust Act. This Act will soon be signed into law and will create a Trust with a governing Council composed principally of Bahamians with representatives of institutions (such as New York Zoological Society) in the United States and elsewhere. Therefore, the Act has international flavor, as the land-and-sea idea deserves.

The Bahamas Trust, like the British Trust, will be a private membership organization empowered by the Legislature to manage lands and waters for the benefit of Bahamians and tourists and for conservation, with the multiple purposes that the word implies. The Trust will work with the government in recommending that certain areas of land and sea be set aside as parks and sanctuaries. Some islands and waters of the Exuma Cays will be the first such area.

“Land-and-Sea Park” means exactly what it says, but most of us are not aware that the land and shallow sea are biologically and geologically part of the same province. The Exuma Cays Park, measuring about 22 by 5 miles, will be the first to protect land-and-sea as a unit on a large scale.

PUBLICATIONS OF INTEREST

TWO LITTLE SAVAGES. By Ernest Thompson Seton, with illustrations by the author. 416 pp. Doubleday & Co., New York, 1959. \$3.95.

“Two Little Savages” was first published in 1903 and the adventures and woodcraft lore of Yan and Sam were (on the authority of one who read the book in 1912) the most wonderful and exciting things that were ever set down in print, or likely to be. Now there is a bright new edition for a much later generation of boys, and if they don’t find it thrilling — well, so much the worse for them. The 1912 generation may be “dated,” but “Two Little Savages” is not. — W. BR.

OF MEN AND MARSHES. By Paul L. Errington. 150 pp., 23 drawings by H. Albert Hochbaum. The Macmillan Co., New York, 1957. \$4.50.

The Twentieth Century has produced its own brand of naturalist-writer. Although he may be as emotionally touched by the world of nature as was his Nineteenth Century counterpart, he is less interested in communicating this feeling to his readers. Instead, his principal intent is to pass on information — facts and principles

acquired through endless hours of observing, counting, measuring and thinking. His aim is to enlighten rather than enthrall. Paul Errington is one of our outstanding students of wildlife. For years he has lived intimately with our prairie wetlands, and out of his tremendous knowledge he has distilled a beautiful and truly satisfying account of marshes and what they can mean to us. This is how a professional naturalist looks at his world. — J. W. A.

AFRIKA vom Mittelmeer zum Aequator. 133 photographs in color and black-and-white by Emil Schulthess. Travel notes by Otto Lehmann, text by Emil Egli and Fritz Morgenthaler. Manesse Verlag, Conzett & Huber, Zurich, Switzerland, 1958. \$14.50.

If there was any doubt that Emil Schulthess, the Swiss photographer, is one of the greatest photographers in the world today, this record of the first half of his African journey should settle the matter. He is. Whether it is scenery chosen with an unerring eye for color and composition, people in revealing attitudes, village commonplaces magically transformed or animals in the most striking settings, Mr. Schulthess can be counted on to take the breath away. Travel notes and text are in German, but the pictures need no translation. The book is large — 10 x 12¾ inches — and many of the plates are folded and therefore huge. And as all work from Conzett & Huber, they are superbly printed. — W. BR.

THE MAMMALS OF NORTH AMERICA. By E. Raymond Hall & Keith R. Kelson. 2 vols., 1,083 pp., 79 pp. index to vernacular and technical names, 500 maps, 538 drawings of skulls, 186 drawings of mammals. The Ronald Press Co., New York, 1959. \$35.

A very useful work for the professional mammalogist and serious amateur, this is essentially an up-dated, illustrated, and briefly annotated version of the 1955 "List of North American Recent Mammals" by Miller & Kellog. It brings together for the first time in one publication detailed distribution maps of all species found in North and Central America. Also included for most species are fine drawings of skulls and sketches of the entire animal. Some of the latter are excellent, but most are undistinguished or poor for the purpose of identification.

Mammalogists will differ with some of the taxonomic interpretations and especially with the senior author's treatment of man and his relationship to the great apes. Laymen having recourse to several field guides on the market will have little need to consult this rather technical work, unless their background is sufficiently technical to cope with some of the scientific terminology.

The chief value to the amateur lies in the delineation and description of species found in Mexico and Central America, a region which is not adequately treated in popular books. — J. A. D., JR.

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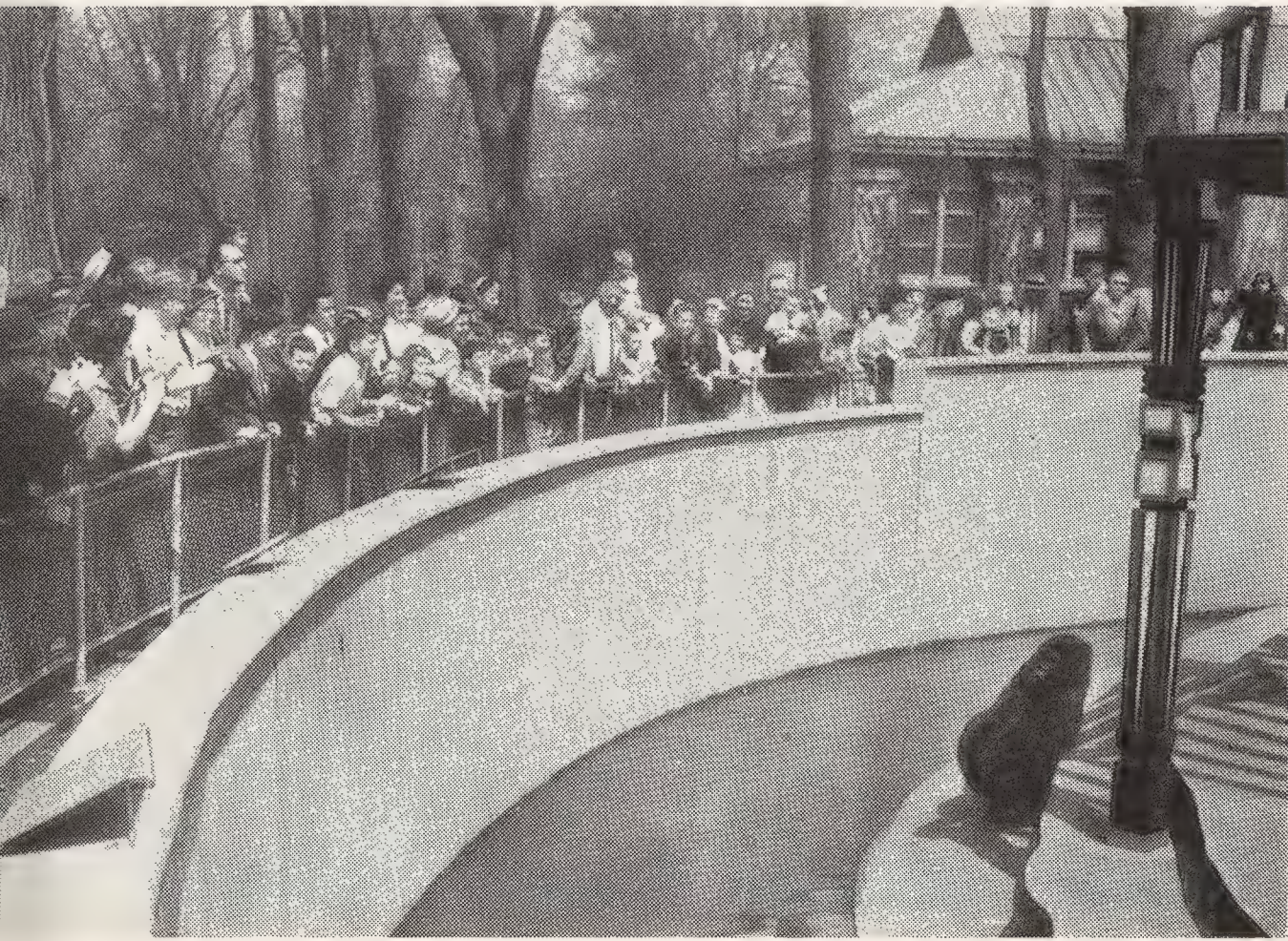
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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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PROGRESS?

THE NEWS that the Atomic Energy Commission is planning an experiment in northern Alaska to determine whether it is possible to create a large man-made harbor by means of a nuclear explosion, is just another case of man's seemingly unquenchable desire to "change the face of the earth." Somehow this news leaves one with a sense of shock. The impact of civilization upon the earth's surface is already so great one wonders how far man can go without causing irremediable damage. Certainly a nuclear explosion of the proposed magnitude may have unforeseeable consequences. I think it was Albert Einstein who remarked that the speed of new inventions far exceeds our acquisition of knowledge of how to use them.

Upon learning of the above plan a letter was sent to the Commission expressing our concern that this project might have serious after-consequences both to land fauna and to marine life. Our letter also recommended that, if the Commission is determined to proceed with the project, a more desirable site would be on the Arctic littoral east of Point Barrow rather than at Cape Thompson on the west coast of Alaska, because the northern coast is more nearly devoid of both human and animal populations. It must be said, in justice to the Commission, that its reply to our letter went into much detail as to the many precautions being taken to insure that there would be no serious biological or ecological consequences. Yet, who knows? It is still highly questionable whether all the after effects can possibly be foreseen.

Man is doing strange things in the name of *progress*. With the new vast powers under his command, he has become a geological force on a planetary scale. Yet the changes he will inevitably continue to make upon the earth constantly threaten to impair the very sources of his life derived from the creative processes of nature.

Fairfield Osborn

Blithe

Beautiful

Tiny and - THE FIRST Tody TO

THE CUBAN TODY that arrived safe and lively at the Bronx Zoo in May, as the first ever to be exhibited, came from the beautiful Viñales Valley in Cuba's province of Pinar del Rio. In the picturesque Rosario Mountains, this vivid little green, red, pink, orange, yellow, blue and golden bird is by no means rare. Neither is the emphatic statement of the Cubans who have attempted to keep it. Repeatedly I was flatly told: "It won't live in a cage."

Questions as to the reason why always brought a hopeless "No sé porqué!" Even bird fanciers who had most carefully tried to keep one said "I don't know why they won't live." Well, now we know something, after collecting attempts over a period of nearly five years.

The Cuban Tody (*Todus multicolor*) is one of a fantastic family found only in the Greater Antilles.

Cuba, Jamaica and Puerto Rico each have one species. Hispaniola has two. All have relatively minor differences and all are restricted to their respective Caribbean islands. The family Todidae is classified, along with the Kingfishers, under the order of Coraciiformes. Even external characteristics and behavior indicate a relationship.

Although the Tody is about the size of a House Wren, measuring only four to four and a half inches, it is blessed with extraordinary personality. Beside being beautiful, it is blithely active — does much flitting, much dainty head movement, frequent puffing out of the feathers and coy elevating of the top-knot. Very perky.

I was introduced to my first Tody in Jamaica in 1955 by the inquiry of my host, Harold da Costa, at Strawberry Hill.

"Have you seen our little robin?" he asked one evening.

The Tody's native name in Jamaica is "robin" or "robin red-breast," and I was to hear entirely different names on other islands.

The "little robin" came each evening to the foot of the garden, where from a high, dead twig he darted out for a supper of gnats. Being so tiny, I often lost sight of him in the failing light, but

could always tell when he was still about by the peculiar, slightly-rattling whirr of his wings as he sallied out to snap his prey.

Strawberry Hill, at 3,000 feet at the beginning of the Blue Mountains north of Kingston, was a delightful birding knob. The hill rose just like an inverted strawberry. The country house on top of the cone was lushly surrounded with old trees along flower-bordered walks that terminated in thick shrubbery.

Here grass-quits, banana-quits, orange-quits, striped-headed tanagers and three species of hummingbirds fed, sang and nested. The slopes of the strawberry, below the garden tip, were so steep no sane horticulturist would attempt cultivation.

Wild mangoes, no doubt sprung from seeds tossed over the brink years before, and wild grasses, shrubs and bamboo provided an ideal habitat for many merry birds. During the day the Todies flashed their brilliance, like the flick of a camera shutter, among the denseness, but toward evening they came out to open perches and, fly-catcher-like, spent the end of the day darting for winged insects.

Eventually, down at the base of the hill, I managed to "tip" a specimen; that is, with a gummed twig on the end of a long pole, I touched his wing and thereby "glued" him to the twig. Within a few minutes, in a fine-barred cage, he was snatching all the insects with which I tickled his beak.

Perkiness and blithesome activity are characteristic of the Cuban Tody and even a photograph reveals its jauntiness, if not the variety of brilliant colors.

He seemed to have no bottom to his stomach, and I quit only when, weary of collecting insects, I judged he had received nourishment enough for a bird ten times his size.

At night I made the rounds of the electric lights outside the house, filling jars with moths, flies, crickets and whatever. He accepted all but hard beetles. For two days I followed the demanding routine of trying to satisfy his appetite.

It became obvious that if I were to get any other collecting done, one of the gardeners, Vincent Walker, would have to take over. Faithfully he carried the cage with him all day as he trimmed the flower beds. I spied on him to see that he was carrying out instructions.

Regularly, at 20-minute intervals, Vincent laid aside his machete, tenderly offered a plump insect on the end of a toothpick. The Tody gulped

BE EXHIBITED ALIVE!

By **OLIVER GRISWOLD**

*Coordinator of Radio, Television and
Film Dept., University of Miami*





it immediately. Vincent fed five or six insects, three times an hour, from about six-thirty in the morning until dark.

Then one morning, in lugubrious tones, Vincent woke me with "The little robin is dead."

The night before he had eaten fully and in fine condition settled down on his perch contentedly. We reviewed all the facts and arrived at no conclusion, except that we had had him for six days and the cause of death was unknown. As we pondered the problem, the Tody was prepared for the University of Miami zoological reference collection.

A few days later, while driving on the Buff Bay Road beyond Hardwar (*sic*) Gap, in search of specimens with Vincent, I saw a Tody snatch a lacy-winged green insect from the air, return momentarily to a perch, then whisk into a small hole in an almost-sheer clay bank.

With a shout I stopped the car; we swarmed up the 30-foot bank, clapped a hat over the hole and grinned at each other. But Vincent's face was long when he announced he had seen the bird leave the hole as we climbed.

"But de little ones is dere," he said.

I hoped they wouldn't be too young. We dug. The clay was tough for the machete. I marveled at the ability of such a little bird to excavate so

The machete gives scale to the nest of a Puerto Rican Tody. From a small opening at the left, the tunnel turned abruptly right to a chamber where eggs had been laid on bare clay. Ferns hid the opening.

Photo by the author.

prodigiously. The tunnel curved slightly for a few inches, then turned right and opened into a round chamber about a foot from the entrance.

The nestlings greeted us with open mouths and much beeping. They were fully feathered and only a few days from flying. I removed them and examined the excreta. It was dark purplish and seemed to contain fine remnants of insect chiton, as well as much unidentifiable material. The purplish I attributed to berries, but there were no seeds.

"These birds are supposed to eat only insects. Do you know any small purple fruit they might get that wouldn't have seeds, Vincent?"

"No, all fruits has dem. Maybe de mama and papa take out de seeds for de babies."

I had heard of stranger things, so retained the remark for further thought.

The baby Todies sat just like their parents, with long bills up at an angle that gave a jaunty air of self-assurance and jovial readiness.

I had rented one of those miniature English cars, which we had dubbed "Bo-beep," for "beep"

was exactly what the "hooters" (British for auto horn) said. In Jamaican mountains the "hooter" is just as important as the motor or the brakes, for the curves are mostly acute, continuous and blind. Keenly aware of this and the sheer plunge down the mountain side that would result from any mistakes of mine about driving on the left, I "beeped" the "hooter" religiously.

Every time I "beeped," from the cage in the open glove compartment the two Todies "beeped" back in perfect duet. They "beeped" in the same key as the horn. The first time I thought it was accidental, but they were definitely responding to the horn. So, a little hysterical over the luck of having, at last, two specimens in just the right stage for cage conditioning, we went down the mountain laughing and "beeping" even on the few clear stretches, just to hear the Todies' ridiculous, jocund echoing from the glove compartment.

It was not so much the comedy of it, but the excitement of feeling that we now had a good chance of taking back to the United States the world's first Todies for exhibition. The babies certainly seemed to possess no fear, although this was their first look at full daylight. On the other hand, they were demonstrating wholehearted cooperation with their new way of life.

These little fellows ate like gluttons on the same frequent feeding schedule and went happily-stuffed to sleep each night. On the fifth morning one was found dead, when Vincent went to feed them between six-thirty and seven o'clock. The other was dead the next morning. Both joined the University's skin collection.

No one in the neighborhood (and the Jamaicans had much love of birds) had any satisfactory explanation. Nor could any one at the Jamaica Institute, with its good staff of fact-packed scientists, explain it.

As we flew back to Miami with a nice collection of Streamer-tail, Mango and Vervain Hummingbirds, we tried to add up what we had learned about collecting live Todies. Practically nothing, it seemed. But perhaps the fact that they always died early in the morning pointed to something.

The quest for a live Tody, although of necessity incidental to other objectives, was none the less kept continuously in mind. I wanted the rarity, first, as a television "prop."

As coordinator of programs for the University of Miami's Radio, Television, and Film Department, it has been my custom personally to produce a series of educational television programs each year about our Good Neighbor Caribbean and Latin American countries. This, in many ways besides television, is a particularly emphasized sphere at the University of Miami.

For program facts, films and "props," Mrs. Griswold and I have travelled to a different country each summer. In addition, I make short, intense trips during the academic Easter vacation, sometimes alone, sometimes with a naturalist team-mate.

Beside general coverage of the country, the shows always include an emphasis on the flora and fauna. The purpose is to entice the viewers who may be inspired to travel abroad to go beyond the cities and the routine resorts for the entrancing values of a first-hand look at the countryside and the wildlife. This, according to my theory of production, gives the shows a host of merits surpassing quickie hops from one foreign capital or resort to another. We cover those, too, but in proportion to the fundamental agricultural and natural resources bases of the countries.

Educational television calls for as much show-business come-on as we can develop. We are always seeking attention-compelling live specimens, keeping always in mind the value of saying, "And now another world's first for our University of Miami programs."

This, of course, is akin to the objectives of "the living textbook" of the zoo. But what do you do with live, rare "props" after a TV show? Logically, send them to "the living textbook" zoo for continued inspiration and education about our Good Neighbor countries. Thus, many of our collecting trophies are on exhibition today in various American zoos.

It was three years and several collecting trips after Jamaica before I headed again for one of the Greater Antilles. This time my colleague was Robert H. Mattlin, Director of the Crandon Park Zoo in Miami. We had done a good deal of Tody theorizing and planning together.

We arrived in Puerto Rico in March, 1958, with several thousand live meal worms and a stock of live crickets. We headed for La Parguera

on the southwest coast within easy reach of good Tody habitat.

Moreover, we had sworn "to cheat that Bird Undertaker," as I called Dr. Oscar T. Owre, Curator of the University of Miami Zoological Reference Collection, out of any more Tody skins. We had no trouble finding the San Pedritos, or Little St. Peters, as the Todies are known to the Puertorriqueños.

We collected eight, and with the demise of each of the first seven, we developed new hypotheses: the mealworms were too large and had too much chiton for such small birds to digest, the crickets didn't taste right, raw beef was too rich, banana was the wrong kind of protein, shredded pineapple didn't wiggle, or we didn't force feed often enough, and so on, until we were grasping at the ridiculous.

Finally, I took the eighth and last surviving specimen with us all day as we went into the field to collect other species. Every half hour, from four-thirty, when we unglued our eyes, until eleven o'clock at night, I pried open his little bill and gently, with a cotton-tipped ramrod, filled him with little gobs of soupy banana, dripping tidbits of pineapple, tenderloin of dragonfly, rib-chops of grasshopper, filet of horsefly, gnats, leafhoppers and hairless caterpillars.

This meant I couldn't go far from the car to collect, for I had to return every half hour to prod more food into the Tody. The car windows had to be rolled up during the operation, for the Tody had to be removed from the cage and held in the hand each time. You can't squeeze. His pep remained perfect, and about every other feeding he managed to flip from my hand and had to be retrieved — and tenderly, too — from among the assorted contents of the sedan, piled full of nets, sacks, cages and the usual stock of photographic and zoological collecting gear. Among these the Tody adeptly played hide-and-seek.

The first minute or two in a tightly closed car in a tropical climate is tolerable. The feeding and retrieving often took twenty minutes. By then my every pore was a river.

"If any one ever asks me if I ever caught a Tody," I told Bob, "I'll have to admit not many, but I've probably set a record for catching the same one more times in the same day — and perspiring more about it."

We shipped our reptiles, amphibians and other birds ahead of us to Miami. As our plane rose over San Juan and headed for Miami, Bob and I peeked into Mr. Tody's cage on my lap and smiled.

It was more than a four-hour flight. I made nine trips to the men's room. This caused some comment among the passengers, and the steward was most solicitous, until I explained about feeding the bird. It was the only place I dared take him out of the cage. I could recatch him in there.

We rushed through the Miami airport and home. After a good stuffing of banana and pineapple, I presented Mr. Tody with five, dark, lively, small wood roaches, enticingly wiggly and visible in a white china dish. He shot down from the perch and gobbled one after another. Then he returned to the perch, preened and seemed to ask for more. I gave him more. He snatched and downed them, returned to his perch and went to sleep.

I ran to the phone and called Bob at his home.

"Hey, we've done it. The Tody is wild about little wood roaches, and I've got a million of them in the mulch pile." Bob was jubilant, too.

Next morning the Tody was dead.

In the fall of 1958, in conference with Lee S. Crandall, General Curator Emeritus of the New York Zoological Park, and William G. Conway, Curator of Birds, I offered the theory that the metabolism of Todies is possibly so high that even though they had gone to sleep stuffed with calories, they perhaps had starved between waking at daylight and six-thirty o'clock when we came to feed them. The fact that neither of these men laughed at my poorly-supported theory, but gave it consideration, encouraged me.

Grasping at the idea, during the winter, I "staggered" my mealworm colony, so that there would always be a goodly number of newly-hatched small ones on hand.

I also prepared several special cages by screening them tightly with fine mesh, so that if a quantity of small, live insects were released inside, they couldn't escape. I obtained two fine-mesh butterfly nets, one for insurance in case the other should get ripped. All these, obviously, were to insure a continuous supply of live insects. These simple preparations proved to be all there was to it — almost.



Through this notch in the wooded cliffs — a perpendicular forest — the collectors passed into Viñales Valley. In the scrub and second growth on the hills in the distance, our Tody was caught in a mist net.

Photo by the author.

Bob Mattlin and I arrived in Viñales Valley in the Province of Pinar del Rio in southwestern Cuba on March 23 of this year, making our headquarters at Rancho San Vicente Hotel. Señor Porfirio Ascuy, the proprietor, who had an aviary collection of native species, shook his head as he added his account of futile attempts to keep Pedorreras, as the Cubans call the Todies.

Nevertheless, with a bundle of mist nets, our "tipping poles," jars of gummy bird lime and photographic equipment, we followed Eliel Dominguez, 18-year-old son of the local "professional" bird catcher, along the trails to good Tody territory.

On either side the weirdly-beautiful, erosion-pocked limestone cliffs rose almost sheer. Deciduous trees, palms, and agaves grew in the pockets, one above the other, giving the unusual effect of a perpendicular forest. We entered an open valley from whose floor rose small limestone mesas, and farther on, climbed rolling wooded knolls. In the scrub and small second growth we soon

heard the Todies, sometimes chattering as though scolding one another. At other times single birds mounted singing perches.

But mainly they flitted like bright little fairies among the low branches of the thickets. They were very difficult to see, for in flying away from us their green backs blended perfectly with the foliage, and a single leaf could hide one.

The day resulted in three fine specimens by "tipping." Back at Rancho San Vicente, we placed all three birds in one of the screened cages.

We felt that if one should start taking food from a dish, the others would learn to imitate him. To begin with, they all chummily lined up side by side. We gave our brilliant little trio a small, shallow dish of water and on the bottom of a white china dish a lively mob scene of tawny mealworms.

As we silently watched, a Tody dropped down and eyed the mealworms for about thirty seconds. With hope, we held our breath. He snatched up a worm, flitted back to the perch, vigorously beat the worm against the wood, first on one side then the other. When he thought he had killed it, down it went, and the Tody dropped to the dish for another, repeating the beating and hasty gulping.



Another Tody, who had been watching, dropped down to the dish and grabbed a worm, and the first Tody was at him in a flash. Furiously they ricocheted around the cage in a whirling fight. Later we wished we had interpreted this action correctly. Instead of being a teacher, the precocious Tody who fed first turned out to be a sheer bully.

In two days, only the belligerent one remained — saucy and strong — while the others were prepared for the museum.

Meanwhile the butterfly nets were put to work, gleaning from nearby meadows a myriad of insects — little grasshoppers, miscellaneous flies, leafhoppers and spiders. These we released inside the mesh-covered cage simply by turning the net inside out. The insects gravitated to the sides of the escape-proof mesh, from which the Tody picked them off at leisure.

Our Cuban Tody at the very start of his career as the first specimen to be exhibited in a zoo. A few minutes after capture he inspected the camera with calm assurance, raising and lowering his tiny crest.

Photo by the author.

As we drove the 135 miles back to Havana, we twice replenished the insects from the roadside. Although we were only a few hours from my aviary in Miami, at the last minute before plane time we put in a two-day supply of mealworms for insurance.

During the six weeks I had him in Miami, I watched him carefully and learned about his astonishing capacity. He ate forty to sixty small mealworms a day, plus morning and late afternoon feedings of innumerable small live insects, mostly leafhoppers swept from the lawn with the butterfly net.

The afternoon feeding was always made more

than enough to carry him well into the next day, I at first thought. But by the time I arrived with the morning food, it would be almost all consumed. So it was increased to an even wider margin of safety.

He proved most tractable at all times, with not even a qualm when the TV cameras came in for close-ups. I was as confident as one can be under the always nerve-wearing imponderables of bird collecting that he would make the trip to New York all right, for as he was being weighed in for air cargo, I could hear him energetically beating a mealworm against his perch.

What have we proved with the world's first Tody for zoo exhibition? First, that scientifically a single experiment doesn't prove anything, really. In addition to the premises on which it was conducted, other unknown factors might have been

involved. For example; this Tody might have been atypically hardy, unduplicated in a thousand specimens.

On the other hand, perhaps the mesh-covered cage, the frequent supply of large amounts of live "wild" insects, plus an abundance of very small mealworms, are actually the answer to the suspected terrifically high metabolism. The evidence seems to point that way, although if it is that simple I wonder why other collectors over the previous years didn't discover it.

Anyone who desires to repeat the experiment is most welcome to the findings. I shall not have a chance to check them again for some time.

Because, for new things, the realm of educational television and "the living textbook" of the zoo are as hungry as a Tody. I'm off next for an entirely different species of "world's first."

Postscript: The Tody in the Zoo

MR. GRISWOLD wrote us in March about the trials of Tody hunting in Cuba, and, later, of his wonderful success. On May 7 the bird arrived in a small cage covered with a fine mesh capable of confining the tiny insects with which the flycatcher-like Tody satisfies its enormous appetite. It is difficult not to be anthropomorphic about such an alert, colorful and tiny tuft of feathers as Oliver's prize proved to be, and suffice it to say that the Tody immediately captured the fancy of the entire staff. One keeper was dispatched, upon the bird's arrival, to capture small insects in the woods east of the Zoo, and another to collect fruit flies and young mealworms from colonies specially nurtured for the Tody's arrival. Special decorations were selected for a Jewel Room cage and two quiet little Golden-headed Manakins from Trinidad were selected to be the Tody's cage mates.

The Tody made his health and appetite known at once. Despite his long trip, not a feather was out of place and he greedily consumed any small live insect offered to him. After a few days we were surprised to find that he preferred rather large mealworms, occasionally touched with a vitamin concentrate, and fruit flies to all else, and found it no longer necessary to make sallies for "wild" insects. A special timing device on the

lights of the Tody's cage makes his day a long one, for Todies will not feed when it grows dark. His exhibit is checked at intervals throughout the day to be certain food is always before him and that nothing has gone amiss.

We don't know just how much the Tody weighs or exactly how much he eats each day, but a safe guess is at least 40% of his own weight. A bird's food requirements are a function of its environmental temperature as well as its activity. Thus it has been shown that at 84°F. a House Sparrow will starve to death in less than 70 hours, but it will die even sooner at colder temperatures. Of course, large birds require comparatively less food, so that David Lack reports that land birds weighing from 100 to 1,000 grams eat 5% to 9% of their body weight each day, while song birds of 10 to 90 grams may eat as much as 10% to 30% of their own weight each day. Hummingbirds will eat twice their weight in syrup in a day, and, generally speaking, insectivorous birds eat a much greater quantity of food than do seedeaters. To a great extent, however, this difference reflects the high moisture content of insect foods. In any event, we intend to continue to give our Tody lots of live insects, to keep him warm and to provide a long, artificially-lighted day in which he may feed. — WILLIAM G. CONWAY

OUR

WHITE-TAILED DEER

PROBLEM

By MILT STENLUND

*Regional Game Manager,
Minnesota Department of Conservation*

IT IS ESTIMATED that there are almost five million White-tailed Deer in the United States today — in some areas probably more than at any previous time in history. Their management and harvesting for sport and food have become a problem of national proportions.

These management problems affect the New England and Lake States particularly because here are found the largest concentrations of white-tails and the root of most problems is centered in over-populations rather than in too few deer. Following similar histories of logging and fires, the white-tail found ideal habitat in the second growth forests and abandoned farms in these two sections.

Warnings from newly-trained game technicians that populations were too high fell on deaf ears, as most sportsmen and game commissions remembered only the lean years when deer were almost extinct.

Technical investigations of the lives and habits of game animals is a new science, first gaining prominence only three decades ago. Prior to this and to a varying extent even today, management and regulation of the deer resource were dependent largely upon game refuges, predator control, closed seasons, tradition and local opinions. It was then common sense to close a season when there was a declining population, and "lots of deer" was the best thing despite the dire consequences of destroyed range and forest reproduction and starvation in the spring.

Big game research, censuses and surveys conducted by growing staffs in State and Federal

agencies and by some private concerns have shown the fallacies of the old beliefs. Factual results have shown that complete protection on refuges and predator control are disastrous on certain areas. The Kaibab Forest story in Arizona is a classic example. Here in 1906 a herd of about 4,000 built up as a result of elimination of the mountain lion and wolf, and complete protection. By 1924 it was believed to number 100,000 animals. That winter the deer died by thousands as the depleted range gave out. Deer continued to die each winter until only about 20,000 were left in 1930 and 10,000 by 1940. The mistakes made then are evident to game managers now, but in those early days refuges and predator control were the accepted practices.

State and National Parks are generally closed to hunting to preserve wildlife for esthetic reasons. As a result deer numbers grew to 75 per square mile in Itasca Park in Minnesota. This tremendous population destroyed the white pine reproduction which was to replace the virgin trees now over-mature and blowing down in the area. The main purpose in establishing the park was to preserve the pine stand for posterity. This was thwarted by the White-tail Deer and an uninformed public. Finally in 1945, when the park was opened to hunting, 42 deer were killed per



section. Continuous open seasons since have made new pine production possible and the new growth is appearing under the old trees. Deer numbers are slowly increasing.

Research teams in New York State have provided valuable information for managing deer. Old time hunters often "aged" deer by counting tines on the antlers — this despite the fact that the number of tines might not change over a period of years. Next a system was used to measure the diameter of the antler at the burr and to correlate this with the age. The system was only moderately accurate. Finally by examining the teeth of the lower jaw, biologists Severinghaus and Tanck devised the technique used commonly today in which tooth replacement and wear are used to age deer with a good degree of accuracy.

New York studies also showed that reproduction in does was closely correlated with winter range conditions. Overbrowsed range produced fewer fawns per doe than did good range with a balanced herd. This can be extremely important, since the number of fawns born during one spring could be halved because does were forced to overwinter continually on range which provided inadequate nutrition.

Antler development was also found to depend greatly on range conditions. Detailed studies showed good antler growth was produced on the best range in New York. On food-rich range in southern Michigan, 95% of the yearling deer produced at least forked antlers, whereas only

30% produced forks on poor range in the north. In some cases, even 2½-year-old bucks in both states did not produce legal-sized antlers — thus eliminating this segment from the huntable population.

Although game managers contended that thousands of deer were dying on overbrowsed range, hunters argued that they had never seen a starved deer in the woods. This is understandable, since most deer died during the spring breakup — a difficult time to be in the woods. Research finally found the "bone marrow" test in which the upper back leg bone is opened to disclose the marrow. Normal marrow is greasy and yellow-white. Marrow from a deer suffering from malnutrition is red and gelatinous with little body. It literally melts in the warm palm of the hand, leaving tissue and a pink liquid. This gives definite proof of under-nourishment.

The mismanagement of the nation's deer herd has been appalling. What makes it even more heartbreaking is the fact that techniques of intelligent management of this resource have been available for at least two decades. Why haven't changes been made? Why haven't tragic losses been eliminated or reduced? The answer is: Because of overwhelming uninformed public opinion. Roger Latham, in a factual report on conditions in Pennsylvania, stated that, "Probably the most formidable problem which has confronted the Game Commission during the past 30 years, and one which has seriously hampered





Both these bucks are 1 ½ years old. The “button” buck is from overbrowsed range in Michigan’s Lower Peninsula. The ten-point buck is from fertile range in southeastern Michigan.

Photo from Michigan Conservation Dept.

scientific management, has been the opposition of well-meaning, but uninformed deer hunters. This active opposition has endangered the future of the sport in Pennsylvania.”

What has been the result of this active opposition in all states having White-tailed Deer? The results are apparent in hundreds of thousands of starved deer during severe winters, because of too many animals carried on a restricted range, in thousands of does shot and left in the woods in “buck law” states, in millions of trees eaten each year by hungry herds, in thousands of dollars of damage to crops and orchards, and in physical deterioration of the animal itself through lowered reproduction, smaller antlers and smaller deer.

How widespread are deer problems despite popular opinion that no problems exist? A survey conducted by the late Dr. Aldo Leopold in

1947 showed 30 states reporting deer problems (White-tailed and Mule Deer).

The single basic cause for most chronic deer problems in the United States has been the “buck law.” As a management technique, selective shooting of bucks only can be an effective way of building a herd. Proof of this are the hundred and more chronic problem areas reported in 1947, many of which were due to protection of does. Forced use of the “buck law,” over an extended period of time without relaxation and against the best advice of professional game technicians, has been disastrous. A poll of states taken in 1956 showed that all 38 states reporting favored hunting deer of either sex and believed it necessary under certain conditions. At that time only five states still had a strict “buck law.” This small number is qualified, however, because in many cases the areas where “any deer” hunting is allowed are restricted to chronic trouble areas such as crop or orchard damage areas. Game agency recommendations to liberalize doe hunting are still overruled by public opinion.

A direct loss attributed to the "buck law" is the does shot and left in the woods. A spring survey made in Jackson County, Wisconsin, in 1956 showed 17 illegal deer were killed for every 10 legal deer taken — or a total of 3,011 illegally-shot deer left in the woods in part of one county. This illegal kill was reduced in 1957 to 1,892 deer by allowing a "party permit" deer of either sex to be taken.

Similarly checks in Michigan showed losses ranging from 25% to 100% of the legal buck kill on areas surveyed.

Perhaps the most devastating loss suffered by deer populations due to antiquated "buck laws" or too rigid protection, is the loss from starvation as a result of too many deer being carried on a restricted winter range. To a rancher it is apparent that too many head of stock on a limited area results in poorer range and eventually in fewer animals. Why, then, is it so difficult to explain to sportsmen that the same principles of management can be applied to deer on an acre of woodland? The average hunter seems to think that these principles are applicable to domestic

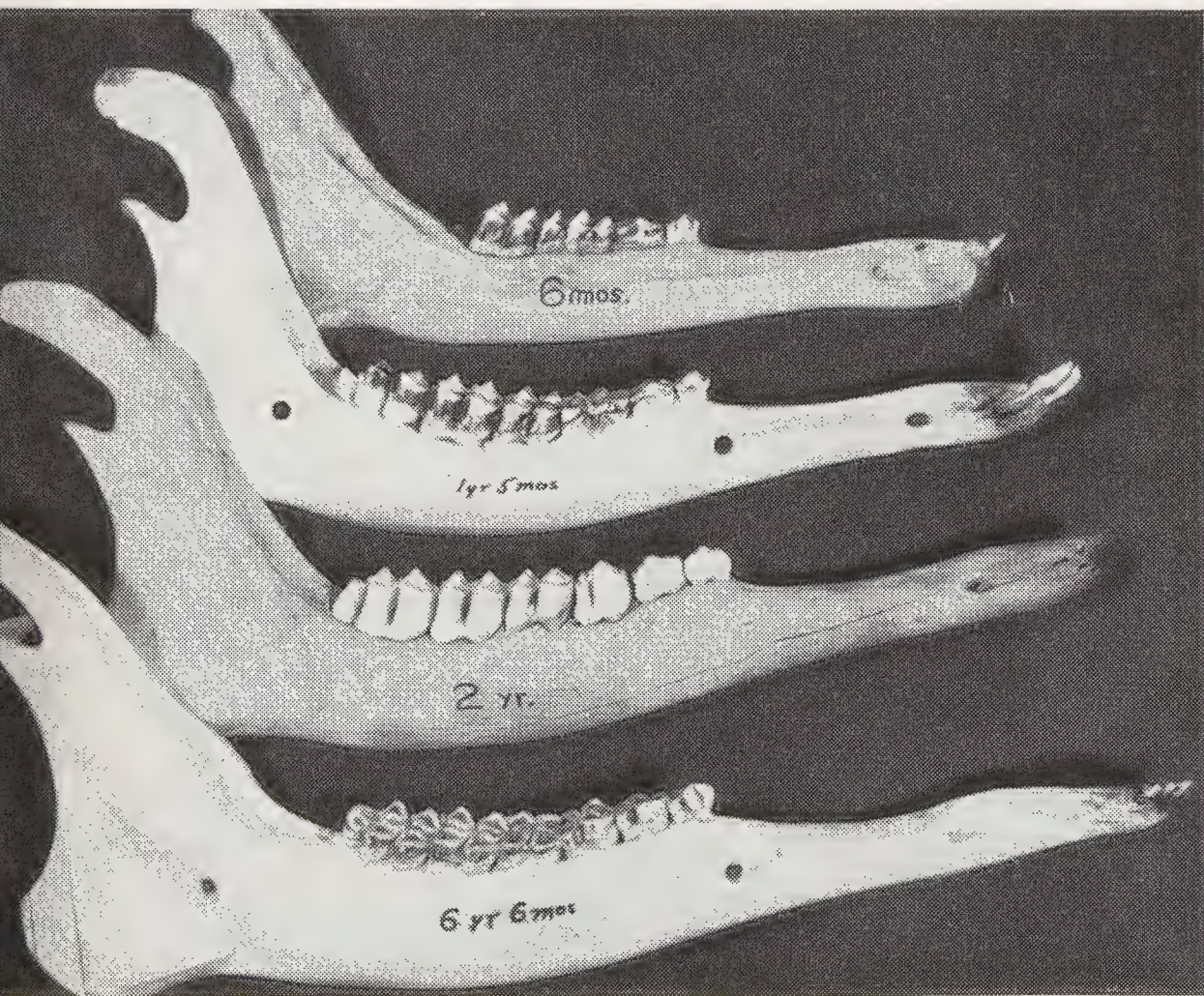
stock but that there is no limit to the number of wild animals that an acre can support. The fact that a certain unit of deer range may have a total of 200 pounds of edible browse and that a deer eating five pounds per day can deplete this in 40 days makes no impression. Many laymen believe there is no limit of "deer food" and that no such thing as starvation exists — but if it does, then deer should be fed artificially!

Examples of starvation in deer herds are legion. The central Adirondacks region of New York is an area where chronic overpopulations have been recognized since the first part of the century. Losses have been as high as 35 deer starved per mile, with 20 dead per mile occurring commonly. During a 24-year period it is believed that the starvation loss actually exceeded the legal kill.

Michigan lost 50,000 deer from starvation during the winter of 1950-1951. About 22,000 of these were buck fawns. This equals the legal take in a special season in 1952.

Minnesota has no "buck law" and has predator populations of Bobcats, Coyotes and Timber Wolves. Hunters take 65,000 to 70,000 deer of any age or sex annually. Despite these decimating factors, starvation has occurred on certain over-browsed winter ranges seven times during the past 26 years, or about once every four years.

The least discernible result of overpopulation is the physical deterioration of the animal itself. This is manifested in lowered reproduction and smaller antlers and size. New York studies show



The new method of determining a deer's age is by noting replacement of milk teeth and wearing of the molars on the lower jaw.

Both photos by Wisconsin Conservation Department, Madison, Wis.

At a deer checking station, inspectors determine the age of a deer taken during the hunting season by using a "jaw board."



does on the best western range averaged 1.7 embryos, whereas they averaged only 1.1 embryos on the poorest Central Adirondacks range. This means 35% less deer are produced on the poor range. In Minnesota's overpopulated St. Croix Park in 1945, does were producing only 0.34 fawns per adult. By 1949, after a large reduction in the herd through hunting, production of fawns had increased three times to 1.2 per doe. Maintenance of overpopulations actually acts as a depressant on the reproductive potential of the herd.

The size and weight of antlers is also determined largely by nutrition. Recent studies in Pennsylvania on experimental deer have shown that reductions in nutrition have resulted in inferior antlers. In the wild this has been demonstrated in New York, Michigan and Wisconsin, where antler growth is far less on overbrowsed range. The direct effect is a reduction in the number of legal bucks available for hunters. How can this be true? After an average or severe winter in the Central Adirondacks, it was found that 50% of the yearlings, 15% of the 2½-year-olds, and 5% of the 3½-year-old bucks did not grow antlers that exceeded three inches in length.

Weights of animals are also reduced on poor range. Wisconsin figures show that adult bucks weigh 12 pounds more on non-critical range. Fawns are also 2.4 pounds heavier on better ranges. Thus the enforced maintenance of overpopulations results in a smaller deer. In comparison, Minnesota fawns which are legal deer during a hunting season, weigh 10 to 15 pounds more than those in neighboring Lake States.

Most hunters are interested in forests and trees. In fact, many of the sportsmen, resort owners and loggers who enjoy deer hunting are directly dependent upon forests for their livelihood. Despite this, groups often lobby strongly for more protection for does to increase already overlarge populations, which in turn can influence to a great extent the type of forest which will mature in an area.

I have already mentioned how an overpopulation of deer eliminated all young white pines in Minnesota's Itasca Park, where the basic purpose of the park was to preserve the pine. In similar fashion certain shrubs and trees such as white cedar, mountain ash, yew and hemlock, which cannot stand heavy browsing pressure, have

been eliminated from deer wintering areas.

In Wisconsin, the devastating effect of deer browsing on tree seedlings was pointed out in a report by De Boer. Although forest managers considered 500 stems per acre as adequate stocking for tree reproduction, heavy browsing by deer had left only 40% of the desired stand in central Wisconsin. In contrast, on the Indian Reservations where there was no deer protection, reproduction was 147% of that considered adequate. The report showed deer were actually eating young trees many times faster than they were being planted.

The story of the White-tailed Deer presented thus far is one of early exploitation and recent mismanagement. Is there any clear answer? Yes! The answer lies in controlling the number of animals using an area. Many and varied attempts have been made to use other methods, but all have failed. Trapping and moving to new areas is impractical, expensive and does not effect the population, because of its high reproductive rate. Planting of feed to replenish overbrowsed wintering areas fails because of expense, and deer and hare populations do not allow plants to reach stages where browse production is good. Feeding deer artificial foods has been tried by most states and given up. Feed is expensive, the deer only choose the best and leave poorer grades, only small numbers can be reached, overbrowsing of nearby natural range is aggravated and, most important of all, even if successful it only means a larger number to feed the next winter.

Game managers agree that herd control is a "must" if intelligent management is to succeed. In some areas it is already too late — ranges will never again support peak populations. Despite intensive and well organized educational programs by Conservation agencies, the public demand for antiquated management measures is heeded by those who must make the final decisions — the various Conservation Commissions. We will continue to suffer annual losses and waste until the public realizes that deer management is stock raising on a big scale. Two hundred head cannot be raised on range that can support only 100. This basic principle of game management must be understood and accepted by the public before intelligent management of the nation's deer herds can proceed.

MAMBO KEEPS COOL

Photos by SAM DUNTON

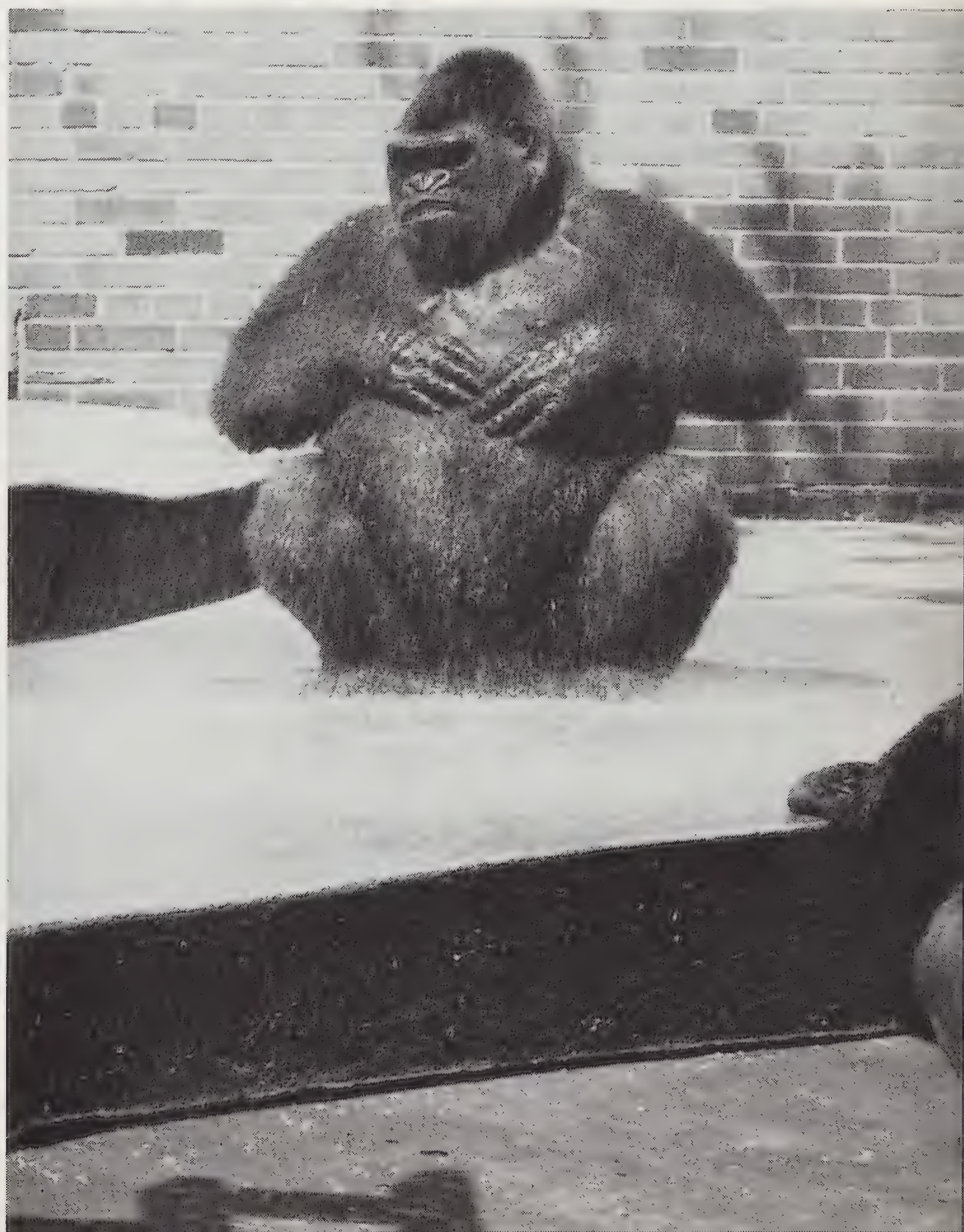
People have showerbaths; why not anthropoid apes? The question was raised by the Mammal Department on one of the hottest of early summer days, and seemed so unanswerable that showers were promptly installed in the Gorilla, Orang-utan and Chimpanzee yards at the Great Apes House. Young **MAMBO**, the Lowland Gorilla, took to the water almost immediately, after first testing it with outstretched hands. His companion, Sumaili, the Mountain Gorilla, has been more conservative and is inclined to stay on the fringe of the water as it sprays from a shower-head at the top of the wall. The picture on this page shows Mambo making a first test.

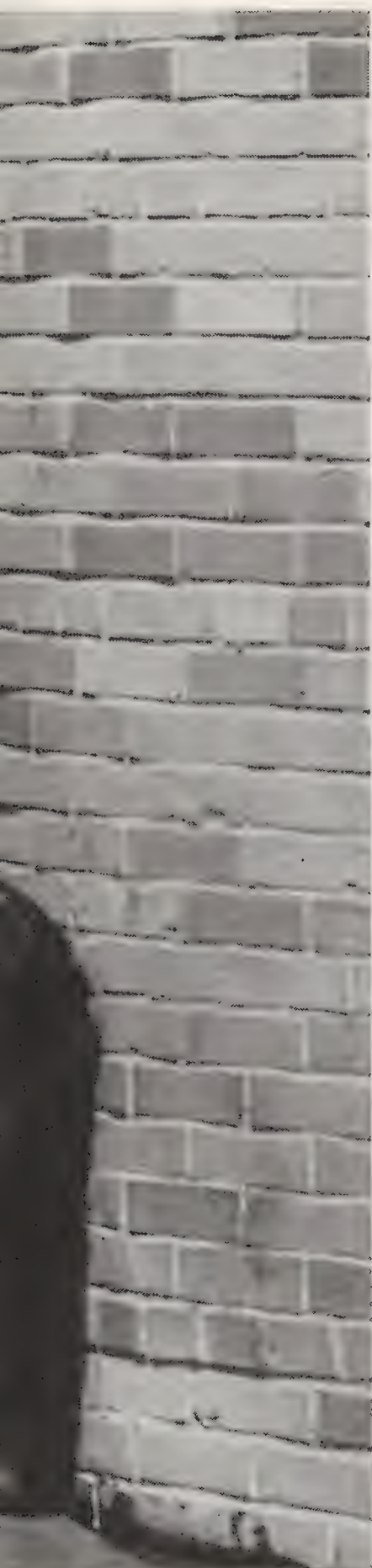




Although the water is warm, Mambo is always a little cautious about plunging in and getting wet all over. Invariably he wets arms and hands first.

Solid comfort! Even Mambo's evident enjoyment of the warm water cannot tempt Sumaili into the middle of the stream, but she crouches on the edge.





Once he is wet all over, Mambo seems to enjoy the spray on his face, for he often turns to catch it in his mouth.

Paddling in the spray, sometimes rolling on the wet concrete, Mambo proves to us that the shower was a good idea.



Rococo Creature of the Sea--

THE BASKET STARFISH



- By CARLETON RAY

WHEN THE FIRST Basket Starfish ever exhibited at the New York Aquarium reached our tanks last April, we lost no time in calling attention to it by a special label over its tank. This gained attention but not always full understanding. We overheard one sample dialog:

"It says here the little things in the water are Brine Shrimp."

"But where's the Basket Starfish?"

"I don't know. It must be in the plant somewhere."

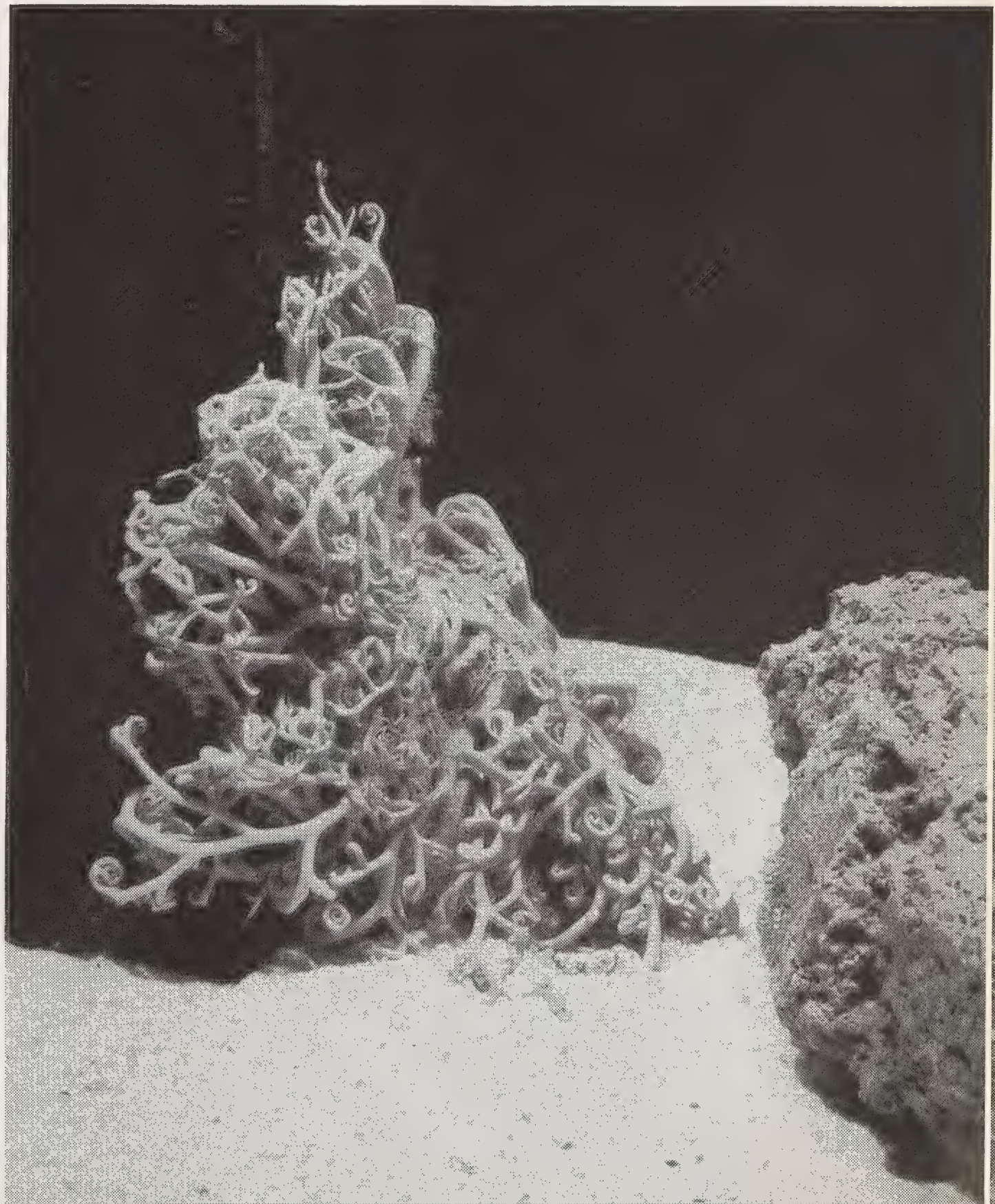
Visitors who persevered and read another line or two learned that the "plant" *was* the Basket Starfish, and the Brine Shrimp were its daily food. From there on, their expressions of surprise and interest always came up to our expectations — for the Basket Starfish is one of the most rococo creatures of the sea.

"Gorgon's Head" is another name for it, harking back to Greek mythology and the three sisters with snaky tresses. Scientifically, our specimen belonged to the Family Gorgonocephalidae or "Gorgon-headed ones." Its generic and specific names we cannot be sure of because the group is a large and complex one and our specimen disintegrated so rapidly after death that there was no opportunity to have it studied by a competent taxonomist.

The brittle stars are probably the most familiar relatives of the Basket Starfish. It is only distantly related to the common, thick-armed starfish — about as closely related as we mammals are to the fishes. Like the common starfish and brittle

stars, the Basket Starfish is built on a pentagonal plan. When young it has five simple arms, but these divide and sub-divide, again and again, to form a mass of slender, flexible, plant-like "branches" and "twigs." Less sub-divided, shorter, stouter arms are used for creeping about. The longer, finer arms are used for feeding. These stars are fragile creatures and have strong regenerative powers, so as the feeding arms are broken or lost they are probably replaced by growing and dividing creeping arms.

Our Basket Starfish lived in the New York Aquarium from April 15 to May 17, which may well be a record for longevity in "captivity." It is certainly not rare in the ocean, for members of the group are scattered through all the seas, from



Left — The Basket Starfish in full "bloom" with its feeding tentacles extended. Right—When it relaxes between feeding periods, the starfish is a compact mass with its branches "wilted" and tightly-rolled.



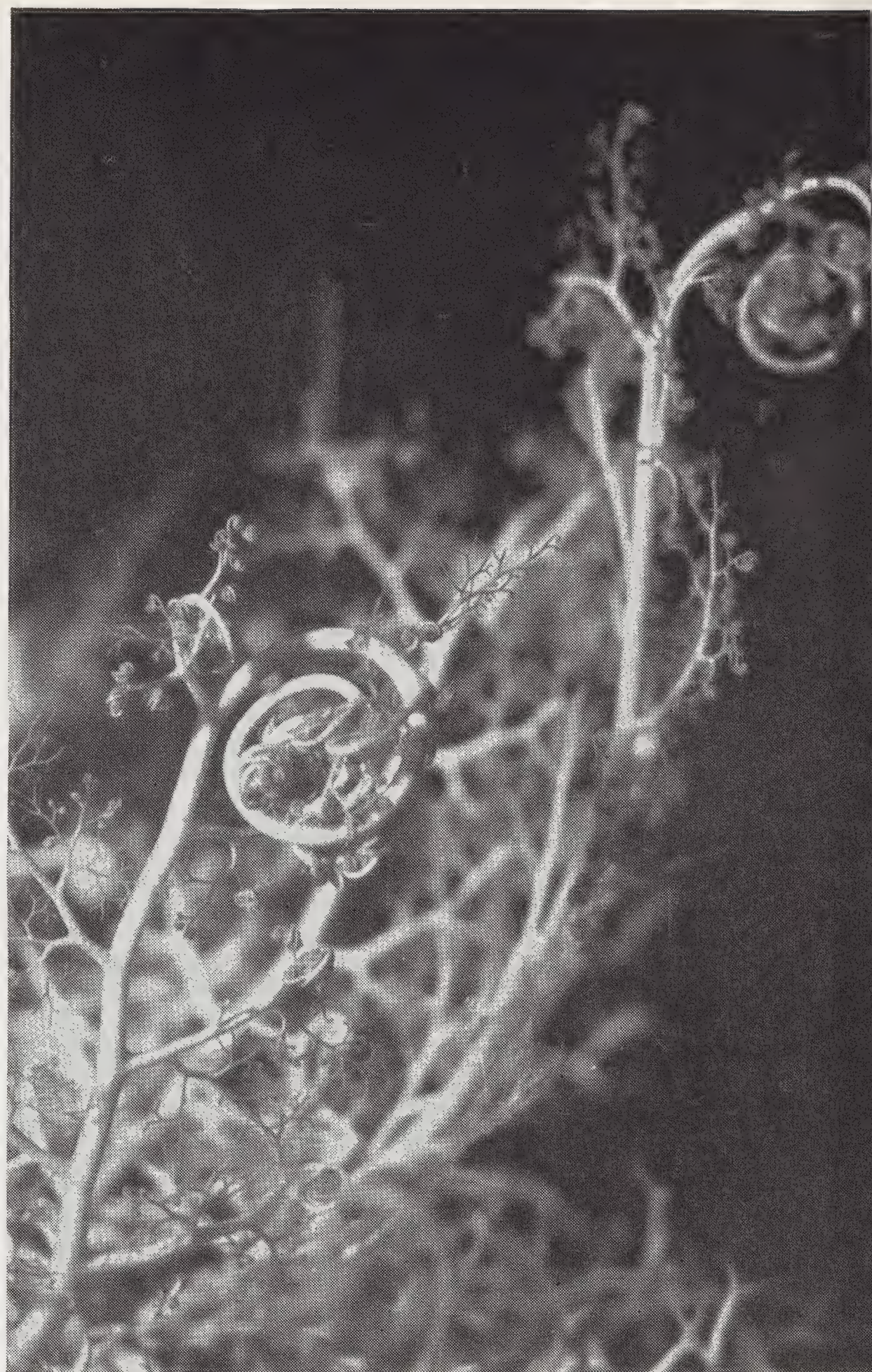
the tropics to the waters of the North Atlantic and from shallow waters to the depths of the ocean. They are bottom inhabitants and are commonly dredged up along both American coasts and along the English coast.

Late in March I was diving in 20 feet of water in Nassau Harbor in the Bahamas when I saw the largest Basket Starfish I had ever encountered. It was clumped up in a hollow on the underside of a rocky coral "head" and was of the ochre variety which seems, in these waters, to grow slightly larger than the dark purple ones.

I gently pulled it from the rock and swam up to the boat at the surface. By the time I got there, the tangled clump had "bloomed" into a fern-like forest of waving tentacles nearly 21½ feet in diameter. I emerged Gorgon-first from the water. The startled boatman exhibited no urge to bucket the creature, which dripped with a clear, colorless mucus. This mucus, incidentally, like that of some other invertebrates, is toxic to small fish.

Fortunately, I was diving with Charles Chaplin, who is sponsoring work on the fishes of the Bahamas at the Academy of Natural Sciences of Philadelphia. After a week in one of the tanks of Mr. Chaplin's excellent private aquarium, the Basket Starfish was put into a fish-shipping container and brought to New York by air.

Once in New York, we had a problem — what to feed it. In the sea, the Basket Starfish eats minute living prey — plankton. Basket Starfish are most common in or near channels where the



current is comparatively strong and the plankton is plentiful. The Basket Starfish is, therefore, a "filter-feeder," a plankton-eater. This has not usually been the evolutionary path to great brain power, though it is an exceptionally successful way of life. Innumerable invertebrates filter-feed: clams, oysters, some worms, sea squirts, sponges and many others. Fewer vertebrates are filter-feeders: baleen whales and fishes such as mackerel and some salmon, the Whale Shark and the Basking Shark. The advantage of filter-feeding is the immediate access to the most abundant food on earth. There is nothing comparable to it on land, since air, unlike water, is a dead medium.

On its first day in New York, as a substitute for its natural food, we offered quarter-of-an-inch-long Brine Shrimp. In swimming more or less haphazardly around the tank, some shrimp inevitably bumped into the clumped arms of the

Basket Starfish, and this contact seemed to stimulate it. The arms began to unfold, slowly, one at a time, passing as they unfolded through a stage at which they resembled nothing so much as the "fiddleheads" of ferns in the springtime.

Fully expanded, our Basket Starfish was a beautiful thing, a living, basket-shaped net of delicate, ochraceous "branches." When a Brine Shrimp touched a tentacle, the reaction was instant and a tendril seized it and rolled it into a tiny clump among the other gently-waving tendrils. Then one after another of the shrimp touched other branches and were similarly ensnared and rolled

Upper left — Beginning to expand in a fern-like motion. The heavier tentacles below are used for creeping.

Left — A closeup of two tentacles in the beginning of expansion. At this stage they are like fern fiddleheads.

Below — Two Brine Shrimp have been captured and are being held by the tentacle, rolled into a tight knot.



up. Half a dozen shrimp seemed to be about a normal load for a single feeding arm. When that number had been snared, the efficiency of the arm as a snare had been reduced and the tentacle began, plant-like, to "wilt." Drooping, drawing together and massing as it descended, the tentacle approached the five-pointed mouth on the underside of its central disc. Invariably we lost sight of the captive shrimp before the tentacle approached the mouth, since there is a thicket of arms around the base. All we know is that somehow — perhaps by being passed from tentacle to tentacle — the shrimp were passed into the mouth. A bellows-like up-and-down movement of the disc went on while the creature was at rest but was especially noticeable during feeding. Perhaps it served the three purposes of the ingestion of food, egestion of wastes and the circulation of water through the Basket Starfish's "water vascular system."

To see the actual mechanics of "swallowing," it would be necessary to observe the underside of the animal and this could be done in a glass-bottomed tank. We shall attempt it next time we have the good fortune to exhibit a Basket Starfish.

During its life we observed that it often took the animal a full hour to expand completely; at other times it "bloomed" with no apparent stimulation, or expanded only part way. Possibly the degree of its hunger or the number of shrimp swimming in the water determined the degree and timing of expansion.

My previous experience with Basket Starfish while skin-diving had led me to believe that they are nocturnal feeders, for I had never seen one expanded during the day. In the Aquarium our specimen was not markedly either nocturnal or diurnal; it expanded at any time in response to food. The only thing it seemed to "dislike" was a sudden change of light conditions. Brilliant photoflood lights were tolerated and the animal "bloomed" normally as long as the lights were not turned on and off at short intervals. Too-rapid changes of light caused it to wilt into an unattractive clump.

Although it was on exhibition for only 33 days, our Basket Starfish drew exclamations of wonder and interest from many visitors. It is not an uncommon creature in the sea; we will hope to bring its fragile beauty to our tanks often in the future.

A Prize for the Zoo
Someday--

THE MOUNTAIN NYALA

By T. DONALD CARTER

*Assistant Curator of Mammals,
American Museum of Natural History*

THE NEW YORK ZOOLOGICAL PARK is known throughout the world for its outstanding collection of mammals. Since its opening sixty years ago, thousands of rare and interesting animals have found safety, food and shelter within its buildings and paddocks. Each year's *Annual Report* lists specimens new to the collection but each year the list becomes more difficult to expand, for at the present time there are very few species of large mammals that have never been exhibited in the Bronx Zoo. One of these is the rare and beautiful Mountain Nyala, *Tragelaphus buxtoni*.

The Mountain Nyala is without question my favorite antelope. Thirty years ago, while I was a member of the expedition that collected the Mountain Nyala Group now in the Akeley African Hall in the American Museum of Natural History, I had the opportunity to visit and study them in their mountain home in southeastern Ethiopia and came back greatly impressed.



Although it was first described in 1910, to my knowledge no live Mountain Nyala has ever reached America. The only one exhibited in any European zoological park was a young male that arrived in the Berlin Zoo in 1933. Even in its limited home range in Ethiopia, it is doubtful whether more than a few hundred exist at the present day.

The Mountain Nyala is not to be confused with the Nyala of Zululand, Nyasaland and the Kruger National Park. An outstanding herd of this more familiar Nyala may be seen on the "African Plains" in the Bronx Zoo. The Mountain Nyala is a much larger animal, approaching the Greater Kudu in size. For comparison, the bull Mountain Nyala in the American Museum's exhibit stood 55½ inches at the shoulder while the male Greater Kudu in an adjoining case was 61 inches. The difference in their heights is in part accounted for by the greater development of the hump on the Kudu's shoulders.



The Mountain Nyala group in the American Museum of Natural History reveals the impressive size of the animal, nearly that of a Greater Kudu. The big bull in this scene stood 55½ inches at the shoulder.

Photo from American Museum of Natural History.

The natives, incidentally, do not differentiate in the names of the Mountain Nyala and the Greater Kudu; they are both known as "Argazin" in the Amharic language.

The horns of the Mountain Nyala and the Nyala are similar in general shape but those of the former are heavier and longer, reaching the length of more than 40 inches in some of the larger bulls. In general color the Mountain Nyala is grayish-brown with white markings. These markings consist of a chevron between the eyes, patches on the throat and lower neck, three or four indistinct vertical stripes on the sides and a longitudinal series of spots on the sides and flanks — hence the antelope's first English name of Spotted Kudu. The cows lack horns and are

of a color similar to the males but with the white markings less distinct.

My interest in the Mountain Nyala was first stimulated in 1925 when Capt. Harold A. White presented to the American Museum its first specimen, the skull and horns of a bull he had collected a year or two previously.

It was shortly after this that the American Museum of Natural History was deciding on what mammals should be included in the twenty-eight groups to be installed in the new Akeley African Hall and it was a foregone conclusion that an animal as rare and interesting as the Mountain Nyala should be represented.

Three good friends of the American Museum, Gertrude Sanford and the brothers Morris and Sydney Legendre, volunteered to finance the building of this group and also to head an expedition to collect the animals and the needed accessories. I was fortunate in being invited to go along as the Museum's representative.

The expedition sailed from New York on December 1, 1928, and reached Djibouti, the capital and seaport of French Somaliland, the day before Christmas. It was a three-day train ride to Addis Ababa, the capital of Abyssinia, for in those days the train did not run at night. (In 1930, when Ras Tafari became Emperor Haile Selassie, the name of the country was changed from Abyssinia to Ethiopia).

The process of getting the expedition's equipment through customs and preparing for the trip into the interior consumed three weeks. Good riding mules were our first purchases, for they were the only means of transportation in the city. The only automobiles in Addis Ababa were those owned by the Ras, and there were no automobile roads outside of the town.

Supplies, including fifty-four mules and three horses, had to be purchased, mostly in the native markets. Twenty boys had to be hired, a mule boy for every four pack mules, a cook, a cook's helper, an interpreter, personal boys and a head man. Dignitaries had to be visited and in return visited us. We were granted an audience with Ras Tafari and a few days later were graciously invited to dinner at the Palace. This was an elaborate feast of fourteen courses with a table service of gold and a bowl of gold fish as a centerpiece.

Two days before our departure Gertrude San-

ford received a riding mule as a present from the Ras. It was a beautiful animal, with a perfect gait. Its bridle, the velvet saddle blanket and part of the saddle were embroidered with bright colors and gold thread. About the mule's neck was a collar made of silver cylinders which tinkled merrily.

SIXTY MILES SOUTH of Addis Ababa is Lake Zwai, the most northern of a series of large lakes that extend toward the south for about a hundred and seventy-five miles. Although the lakes are separated by short distances, the water in some is alkali while in others it is fresh. Many hot springs are found along their shores.

Just to the east of these lakes the land rises steeply to form the Arusi Plateau. Much of this plateau is a great grass-covered plain which reaches an altitude of 8,000 feet. Along its western sector the plateau rises to greater heights and forms the Chillalo or Sagatu and the Geder Mountain ranges, between which flow the headwaters of the Webbe Shibeli river. Several of these mountain peaks rise to more than 13,000 feet and from about 8,000 to 9,000 the slopes are covered with forest in the higher altitudes of which are dense stands of bamboo. Above the bamboo the country opens up and the slopes and summits are clothed with a giant heath, *Ericinella manni*, some of it six or seven feet high. Many of the ridges have eroded away to form steep cliffs.

This unique and spectacular country extends in a north-south direction for about a hundred miles and east-west for about seventy-five miles. It is here and only here that the Mountain Nyala makes its home.

Six days after leaving Addis Ababa we camped on the eastern shore of Lake Zwai. We were informed by natives that the nearest place we could find Mountain Nyala was on Ansha Mountain about three days away. Camp was made at the edge of the forest at its base. Early the next morning we set out on muleback to search for Nyala on the upper slopes. We each took a separate game trail up through the forest and later through the dense bamboo jungle. Upon emerging from this darkened tangle I faced a new world. There before me and reaching three thousand feet above to the mountain's very summit was a vast expanse of heath, miles

of it as far as the eye could see. High above, near the mountain top, were some cliffs with great masses of fallen rock at their bases. Later I was to learn that what appeared to be a smooth expanse of heath was in reality a series of washes and gullies, with scattered stones and boulders, making very difficult traveling.

I left the boy with the mules at the bamboo edge, going on alone. The boy had on a white toga, which I felt was not conducive to stalking Nyala. I climbed nearly to the summit, seeing very little sign but enough to know that Nyala did exist there. Throughout the day I saw no Nyala but I was not disappointed. I had had a most invigorating day in the home of the Mountain Nyala amid some of the most picturesque mountain scenery it had ever been my privilege to enjoy.

Upon my return to camp I learned that one of our party had had a fleeting glimpse of a Nyala at the edge of the bamboos.

Three more days were spent on Ansha Mountain with little result and it was decided to try elsewhere. A visit was made to Chief Pasha Tasama and he assured us that we would find greater numbers of Nyala on Kaka Mountain, two days' travel to the south.

Kaka Mountain was even more impressive than Ansha. Again we made base camp at the edge of the forest at the mountain's foot. The next day we moved three of the tents and pitched them beside a spring of ice-cold water among the heath. This was to be our home for the next three weeks.

From the signs about camp, Nyala were plentiful and that very afternoon I was to experience one of my greatest thrills, seeing my first Nyala. I had been out all the morning and was returning toward camp, following up a draw which had kept me hidden for some distance. This draw became more shallow and as my head arose above the bank a movement toward my left attracted my attention. There, feeding on the heath about one hundred and fifty yards away, were three Nyala — a good bull, a cow and a young bull with horns about eight inches long. It was a beautiful sight in an enthralling setting. The lighting was perfect with the sun behind my back. In front of me and beyond the antelopes were the heath-covered slopes of the mountain

reaching to the three distinct peaks. The clear, cool mountain air added to the perfect picture. For fully five minutes I watched the animals quietly browsing, as first one and then another would nervously look up, with ears thrust forward, and then return to feeding. A tricky mountain breeze must have carried my scent to them, for at the same moment three heads shot up and all gazed in my direction. Suddenly they all wheeled and ran, the cow leading, followed by the young bull, the old bull bringing up the rear.

After that first day I saw many more Mountain Nyala, but it is these three, in their majestic yet typical setting, that stand out most clearly in my memory.

For three weeks we lived among the Mountain Nyala on Kaka Mountain. We discovered that they seemed to prefer to spend the nights and the heat of the day in the bamboos and the forest below, coming out to browse on the heath and graze on the patches of grass upon the mountain side during the early morning and evening. They were wary animals and if at all disturbed they would quietly slip into the forest cover. We

also discovered that it was almost impossible for us to hide our early morning approach up the mountain side. We decided upon a plan to outwit them.

On Kaka Mountain there were a number of peaks, three of which gave commanding views of the slopes. We each chose one of these peaks and had our cots and blankets placed there. Here we spent the night to await the morning and the Nyala as they came up the mountain to feed. It was cold, ice forming in the buckets every night, and almost every morning there was a dense fog covering the mountain top until it was quickly dispersed by the rising sun. But it was well worth the discomfort, for with our binoculars we could watch the unsuspecting animals below us.

The older bulls seemed to prefer the higher reaches and many of them appeared to live a solitary existence. We did see small parties con-

During the early morning and evening, the Mountain Nyala came out of the forest and bamboo below and grazed among the tall grass on Kaka Mountain. This is the approximate scene recreated in the Museum exhibit.

Photo by the author.





sisting of a bull with two or three cows, two or three bulls together and as many as nine cows in one herd. We found a few cows in the more open forest where it joined the plain. We found no evidence of very young calves. We also discovered that not all the animals went down to the forest for the night, for on several occasions, in the early morning, we jumped a bull from where he had bedded down in a thick clump of heath. In fact, Nyala could be found on the upper slopes at any time of the day.

In all, we estimated we observed about forty Nyala during our stay on Kaka Mountain.

Beside man the Mountain Nyala has few enemies. Leopards occur quite commonly throughout their range, even inhabiting the higher mountain tops. These big cats undoubtedly take their toll, especially of the younger animals. The altitude is too high for lions.

Klipspringers were common on all the rocky outcroppings and these mountains are the home of the blackest of all the bushbucks, Menelik's Bushbuck, *Tragelaphus scriptus meneliki*. A nice male of this bushbuck was observed climbing among the rocks on the summit of Kaka Mountain at an altitude of 13,000 feet.

Lammergeyers, the large bearded vultures, *Gypaetus barbatus*, were not uncommon and a

Here, on the Awash River, a full day's trek from Addis Ababa, the Museum's party made one of its camps. Today excellent automobile roads cover at least part of the journey made laboriously in 1928.

Photo by the author.

pair with their blackish-brown offspring were seen on Kaka almost daily.

There are two animals, a mammal and a bird, that are found exclusively on the highlands of Ethiopia. The first is the Abyssinian Wolf, *Simenia simensis*, a canid about the size of a small coyote, but with a reddish coat, which gives the animal the appearance of a long-legged red fox but with a shorter tail. It has a much greater range than the Mountain Nyala, being also found in the mountains to the north and west of Addis Ababa. It was not uncommon on the Arusi Plateau, preferring the more open plain-like country. Small rodents appear to be its favorite food. This plain was the home of countless rodents, one of the commonest of which was a large grass rat, *Arvicanthus abyssinicus blicki*. These grass rats live in colonies, after the manner of Prairie Dogs, the entrances to their innumerable burrows being conspicuous features of the landscape, and these towns appear to be the favorite hunting ground for the Abyssinian Wolf. We found that the best way to observe the

wolves was to secrete ourselves near one of the grass rat colonies either in the early morning or in the late afternoon. There was a very good chance that a wolf might come by.

The one wolf's stomach that we examined was full of the remains of locusts.

This wolf is another interesting mammal that has never been exhibited in the New York Zoological Park.

The same country is the home of the Abyssinian Blue-winged Goose, *Cyanochen cyanopterus*. In general color it is brownish-gray. The wing-coverts are of a light slaty-blue, which gives the bird its English name. It has a peculiar habit of resting its neck along its back and fluffing out its feathers, especially when it is disturbed.

The plateau is crossed by a number of small meandering streams along the banks of which fresh green grass grows. It is here that the geese are found. Generally associating in pairs, they are tame and confiding birds. If flushed they generally fly at a low elevation and for no great distance. Their distribution is almost as restricted as that of the Mountain Nyala.

Although this goose is rare in captivity, it appears to be hardy and there are numerous occasions where it has bred in confinement.

IN MARCH OF LAST YEAR I again had the opportunity of visiting Ethiopia. Since my last visit thirty years before, the country had undergone many changes. It had experienced the Italian invasion and Addis Ababa had become a modern city.

Newell and Bettina Ward and I had just completed a safari in Kenya. Our Ethiopian Air Lines plane put down at the airport in Addis Ababa. Taxis were waiting to take us to the comfortable Ras Hotel. A tour of the city showed us modern office buildings, modern stores, many new schools and wide, paved streets. Automobiles were everywhere. The railroad station, where we had spent long days arguing with the customs, and some of the native markets, were the same, but everything else showed progress. Again we received an invitation to call on Emperor Haile Selassie but unfortunately the invitation was for the day it was necessary for us to leave for home.

Our stay in Ethiopia was limited to three days. Robert Proctor of the American Embassy volun-

teered his services and that of his car. I immediately asked him if it were possible for us to take a trip to the Arusi Plateau. He said that it would be impossible to reach the plateau but there was a good road that skirted the western shore of Lake Zwai and the trip and return could easily be made in one day.

The road to Lake Zwai proved excellent, much of it blacktop. Instead of the caravans of camels and mules laden with coffee, hides and grain for the markets of Addis Ababa, we passed great, heavily-laden trucks, many of them with the same produce.

We turned off the main highway onto a sandy road which was in reality a series of cattle paths, and soon came to the shores of the lake. This proved to be the watering place for the cattle and goats of the local people. Over a hundred head were on the shore and out in the lake, some of them standing with only their heads and upper backs above the water. Across the lake and in the far distance rose the high mountains of the Arusi Plateau. I could not distinguish any of the peaks and the natives could not give us any names. As it was still early we continued south until we reached Lake Shala. Mt. Kaka is about forty miles due east of this lake and although I saw a mountain which was in the right position and seemed to have a familiar outline, I could not be sure. Nevertheless it brought back pleasant memories.

To my inquiries about the present status of the Mountain Nyala I received conflicting replies. The general opinion was that they were still found in their old haunts but in reduced numbers. They are now classified as royal game, which gives them some of their much needed protection. Undoubtedly the animal owes its existence at the present day to the inaccessibility of its habitat and also to the fact that the country is unfit for the grazing of domestic stock. Should the mountains be exploited, should minerals be found there, or should the great heath fields be destroyed, the Mountain Nyala would be doomed and the world would lose one of its most beautiful and interesting large animals. Let us hope that none of these things come to pass and that future generations will still know the Mountain Nyala whose stately bearing is so in keeping with the scenic beauty of its environment.

A Giant Pouched Rat in the Zoo

By JOSEPH A. DAVIS, JR.

AT FIRST GLANCE the Giant Pouched Rat looks like a sleek Norway rat surprisingly grown to far more than normal size. From nose to tip of tail, a full-grown *Cricetomys gambianus* measures about three feet, half of which is tail.

Cricetomys is one of only three genera of Old World rats in possession of cheek pouches. Strangely enough, the most unusual thing about these cheek pouches — or, for that matter, about the rat itself — has not been recorded by those who have kept these rodents alive.

Some months ago we ordered a trio of half-grown Giant Pouched Rats from Mrs. Dora Weyer, the wife of a rubber company official in Liberia, thinking that rats of such gargantuan proportions would be a striking addition to the Zoo's collection. They arrived in late June and as we removed them from their shipping containers we were prepared for an interesting sight, but hardly for what emerged from the first container. Out came a large rat with a bad case of mumps. We had unpacked the male first, and his pouches seemed to be crammed nearly to bursting with food. His head bore a grotesque and ludicrous resemblance to a balloon. Popping him into a temporary cage, I hastened to call witnesses to this strange sight.

But when I returned a few minutes later, there he sat, with a slender, normal head.

"Must have emptied the pouches already," I



His cheeks puffed out, the Giant Pouched Rat attempts to intimidate the photographer. This is the animal's typical pose as it threatens.

said, and bent close to find the jettisoned food. There was none. But as we drew near, *Cricetomys* reared up on his haunches and, with much huffing and puffing and wheezing, inflated his cheeks with air! We crouched in amazement for nearly a minute, the rat occasionally wheezing, presumably to maintain pressure.

Eventually I remembered the two females, still unpacked. They were much more placid but they, too, could be induced to give the same performance upon proper stimulation. Ordinarily we go to extremes to avoid exciting any Zoo animal, whether rare or easily replaceable, but I *had* to know whether the male alone could puff up his cheeks. The animals had been hand-reared by Mrs. Weyer and gentle poking at them drew no response. The proper stimulus, as I found it and rather self-consciously applied it, was to puff out my own cheeks and reproduce the rats' own wheezing sound. Thereupon both males and females would respond with swelling pouches.

This puffing of the cheeks is, as far as I can discover, peculiar to the Giant Pouched Rat. Published accounts of its behavior, however, make no mention of it.

Indeed, the published accounts tell compara-

tively little. *Cricetomys gambianus* is the only species in its genus. It ranges across Africa in a broad belt about the Equator and down the eastern half of the continent south to Northern Transvaal. Its color varies geographically from a pearly gray to chocolate brown (our specimens are brownish). The nearly naked, scaly tail is dusky, with the terminal third whitish. According to G. S. Cansdale, adults weigh about two pounds — not a bad weight for a three-foot rat, half of which is tail.

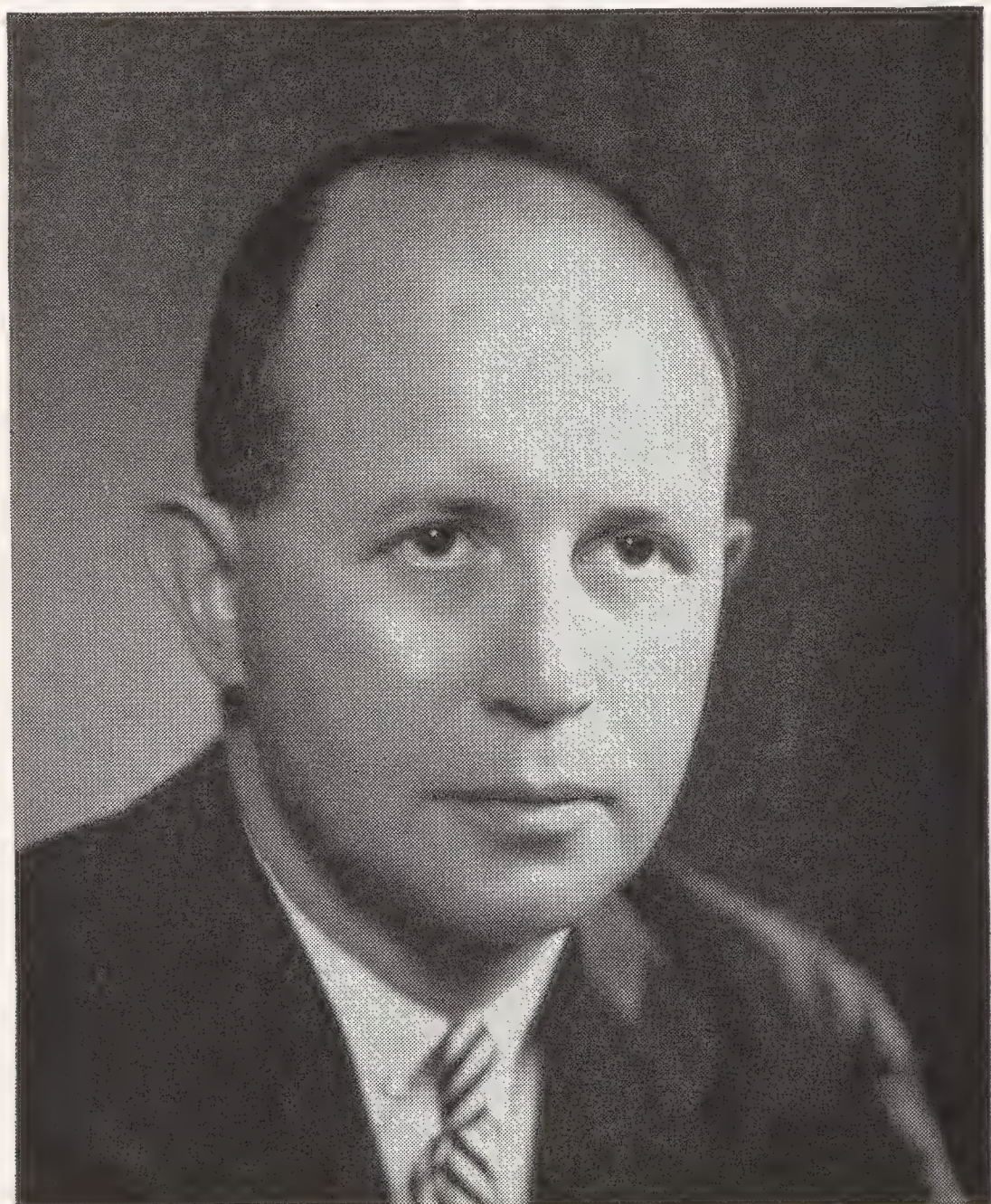
How the rats are hunted in Liberia was described by Mrs. Weyer.

"There is no question in my mind but that this is a communal species in general here," she wrote. "I have never heard of a solitary one. It is customary for this species to be hunted for food by the natives here; it is, in fact, one of their

most favored meats — 'sweet-o-o' as they call it. Throughout the country it is regularly hunted in the same way. That is to find a large termite nest — the high dirt ones — and hunt around its base for runs that indicate use. The men go in groups of ten to twenty when they find such a nest, cut down all the brush surrounding it, and a man or two stands at each exit hole armed with his cutlass. Then they build a fire at the main entranceway, pile some of the fresh-cut greenery on it and smoke the rats out."

Mrs. Weyer added that it is almost impossible to obtain specimens of the rat because the natives prefer to eat them and usually will not sell them either for money or equivalent meat. Our three came from a litter of five very young babies obtained by Mrs. Weyer from a hunter in a nearby town.

CONSERVATION



Paul F. Brandwein

Paul F. Brandwein, Director of Education for The Conservation Foundation, holds the degrees of A.B., M.Sc. and Ph.D. in Biology. He has been a high school teacher and has taught at New York University, Columbia and Harvard.

FOUNDATION

His experience in conducting seminars, conferences and workshops for teachers in many school systems led logically to his initiation of the Materials Development Centers Project for the Foundation. This project encompasses the establishment of ten education centers in widely separated parts of the nation. Each will specialize in resource problems which are of particular importance to the region where it is located. Each will develop materials (teaching tools) designed to deal with basic problems in the wise use of resources. Each center will exchange its materials with others and will develop out of experimentation with local schools and universities a series of publications to be titled "New Directions in the Teaching of Conservation." Two centers already in operation are the Curriculum Center in Northridge, Calif. (San Fernando State College) and the Water Materials Center at Colorado College, Colorado Springs. With plans projected and work well under way, Dr. Brandwein is a busy man.

Small Woodland Exploratory Study

The Foundation has initiated an exploratory study of problems relating to utilization of timber stands on small woodlands throughout the country, in order to determine whether there is a significant contribution it might make in this area, either in research or education.

The first phase of the exploration has consisted of communication with a number of foresters in government, industry and universities and was inspired by the concern voiced by Dr. Richard E. McArdle, Chief of the Forest Service, that "... on over one-half of the recently cut farm and other small private forests, conditions for future growth are far from good."

The second phase of this project involves conferences with Walter Gumbel, Conservationist, of the Monongahela Power Company, to explore possibilities for collaboration on a study of woodland utilization problems in a specific depressed area, possibly West Virginia. The survey is being made under the direction of Roger Hale and Wallace Bowman.

Max Nicholson Reports

Recently returned to England from an extended resource tour throughout the United States, Max Nicholson is preparing a report to the Nature Conservancy, of which he is Director. Excerpts from his preliminary draft indicate that the work of The Conservation Foundation made a favorable impression, for "... it is from such

sources, preponderantly unofficial, that a great deal of the thinking and re-thinking and the broad inspiration of the American effort in conservation stems."

Briefly Noted

G. W. Merck was named Secretary of The Conservation Foundation at a meeting of the Board of Trustees on June 17 . . . Wallace Bowman covered the Symposium on the Economics of Watershed Planning at Knoxville on June 10-12 and then went to Chicago to meet with Dr. Gilbert White of the Foundation's Advisory Council . . . Copies of the Foundation's publication, "Water Facts for the Nation's Future," by Langbein-Hoyt, have been sent to each of the 17 members of the new Senate Select Committee on National Water Resources, and are available from the publisher, Ronald Press . . . Samuel Ordway's report on "The Law and Progress in Conservation" was printed as the lead article in the June issue of the *Journal of Forestry* . . . Fairfield Osborn recorded a program for the NBC-TV series "Briefing Session," entitled "Populations and Resources," on May 12. The program is now being shown throughout the country and will be seen in New York over Channel 4 on August 16 at 2 P.M. . . . Dr. Osborn also recorded a session of the "I Speak for Myself" series entitled "Wasteland: The Ugly America," on July 8. This program appeared on Channel 5 on July 26.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Dr. Oliver Becomes Director of Natural History Museum

Dr. James A. Oliver, Director of the Zoological Park since June of last year and Curator of Reptiles since 1951, has accepted appointment as Director of the American Museum of Natural History. He will assume his new post on September 15.

Dr. John Tee-Van, General Director of the

New York Zoological Park and the New York Aquarium since 1956, will again assume directorship of the Bronx Zoo. He had been Director from 1952 to 1956.

Traditionally there has always been close association and cooperation between the Zoo and the Museum, and with a "zoo man" in the Museum's chief administrative post the relations should be even closer. During his eight years in the Zoological Park Dr. Oliver established one of the

best reptile collections in the world and contributed immeasurably to the creation of what is certainly the most beautiful Reptile House in any zoo. During his brief directorship he demonstrated firm and forward-looking administrative ability and many qualities which make his departure a great loss to the Zoological Park. He will go to his new post with the warmest of good wishes from his associates and his friends in the Zoological Society.

Honorary Degree for Dr. Osborn

The honorary degree of Doctor of Laws was given to Dr. Fairfield Osborn by Kenyon College of Gambier, Ohio, on June 8. The citation concluded:

"Today, within sight and sound of the wildlife you love, we recognize your invaluable contributions to the knowledge of our living world, your high degree of skill and effort in organizing the desire and means to preserve our irreplaceable flora and fauna, and the thousands of fruitful hours you have spent in furthering the cause of conservation."

Dr. Osborn was given the degree of Doctor of Science by New York University in 1955 and by Princeton University in 1957.

A King Penguin, Perhaps?

For the fourth time in recent years one pair of our King Penguins are incubating an egg. It was laid on June 7 and should — if it is fertile and no accidents happen — hatch about August 1. Previous eggs were lost by being accidentally cracked on the stone ledge in the Penguin House.

To forestall such an outcome this time, a stone wall was built around the incubating birds as soon as the egg was discovered, and it was bedded on a deep layer of sand. The egg has been exchanged several times between the male and the female, which hold it on their feet.

Incidents in Vermont

From Vermont where he is spending the summer Dr. William Beebe has sent a report on the activities of the Department of Tropical Research. At the end of the report he wrote:

"Within the past week (the report was written in May) a Mohawk Indian on a neighboring reservation disarmed, shot and killed a State Trooper. On the same day I was watching a bird

through a window when suddenly there came a thunderous roar and the glass before me cracked at the impact of a jet plane high overhead breaking the sound barrier: a striking example of Alpha and Omega in American history.

"(Parenthetically, the bird I was watching was a Yellow-bellied Sapsucker which, for two days, has been happily hammering on the television antenna, producing a pleasing, metallic, bellbird-like reveille, and stopping only to feed on doughnuts at the food tray; excellent examples of adaptation to a modernistic sounding board and a remarkable substitute for sap.)"

IN BRIEF

Rare Monkey. Late in the spring the Mammal Department acquired a Woolly Spider Monkey (*Brachyteles arachnoides*) from southeastern Brazil, the first we have ever had and apparently the first in any American zoo. Hand-reared and accustomed to human companionship, it was so obviously unhappy when alone that it has been given a gentle Humboldt's Woolly Monkey as a companion in one of the central compartments in the Monkey House.

Death of a Komodo Monitor. After several weeks during which it was listless and off its feed, our male Komodo Monitor died on July 3. The female appears to be in good health. Autopsy by Dr. Gandal revealed kidney, liver and heart lesions which are still under study. Death appeared to be due to uremic poisoning resulting from kidney malfunction. The reptile weighed 218 lbs. and was 8 feet 9 inches long when it arrived on May 22, 1955; at death it weighed 238 pounds and was 8 feet 10 inches long. Eventually it will be mounted and exhibited in the Peabody Museum in New Haven.

PUBLICATIONS OF INTEREST

ELEPHANTS. A Short Account of Their Natural History, Evolution and Influence on Mankind. By Richard Carrington. 272 pp., many photographs and drawings. Basic Books, New York, 1959. \$5.00.

A "Short Account" it is called, but this book brings together an enormous amount of information about elephants, from old and modern sources. It is thoroughly documented, there is a long bibliography and an excellent index. This is a one-volume library of "elephantology." — W. Br.

FUNDAMENTALS OF ORNITHOLOGY. By Josselyn Van Tyne and Andrew J. Berger. 252 illus. in black-and-white, including 168 by George M. Sutton, others by William L. Bruden and William A. Lunk. John Wiley & Sons, Inc., N. Y., 1959. 624 pp. \$11.75.

This long-projected text-book to which Josselyn Van Tyne, major ornithologist and teacher, had devoted years of preparation, might never have reached completion following his death on January 30, 1957. However, Andrew Berger, devoted friend and fellow naturalist, carried out a half-made commitment to see it through. The result is a superb compilation of present knowledge, covering every field of endeavor in bird study, including Senses and Behavior, Migration, Flight and a fine chapter on Anatomy, Dr. Berger's special field. A complete account of the known Families of birds occupies 176 pages. Each is illustrated by a drawing that reveals George Sutton's great talent at its best. Long and use-

ful lists of references, an unequalled glossary of terms and an excellent index round out a work that will be a boon to students and to advanced workers as well. — L. S. C.

FISHES OF THE GREAT LAKES REGION. By Carl L. Hubbs and Karl F. Lagler. Revised edition. 213 pp., 45 color plates, 251 black-and-white figures. Cranbrook Institute of Science, Bloomfield Hills, Michigan, 1958. \$5.00.

This new edition of one of the standard books on North American fishes is both enlarged and improved, although the latter represents a refinement of excellence already attained. No practicing ichthyologist or beginning student of fishes can afford to handicap himself by not having a copy within arm's reach. To anyone else who really wants to know and identify the fishes of our midwest, the book's illustrated keys and introductory sections are also indispensable. — J. W. A.

New Members of the New York Zoological Society

(Between May 1 and June 30, 1959)

Benefactor

C. Suydam Cutting

Founder in Perpetuity

Warren Kinney

C. D. Stillman

Founder

Mrs. William R. Coe, Sr.

Associate Founder

Walter C. Teagle, Jr.

Patron

Mrs. Joseph F. Gunster

Fred A. Wardenburg

Supporting

Kimball C. Atwood, Jr.

James C. Clark

Mrs. Alice B. Colby

Mrs. Stephen Currier

Kenneth A. Jones

John S. McIlhenny

Contributing

Albert Andriesse

Donald R. Arnold

Elmer K. Bolton, Jr.

Fred Cooper

Miss Margaret Davidson

A. M. Davis

Dr. Charles R. De Carlo

Richard L. Farrelly

H. O. H. Frelinghuysen

Eugene M. Geddes

Kim S. Gudgeon

Mrs. Hamilton Hadley

Samuel Howard

Mrs. Francis L. Kellogg

Mrs. Martha G. Kendall

Miss Alice C. Kraus

Dr. Herbert S. Kupperman

Jonathan Lehman

Mrs. Robert J. Lewis

Mrs. Henry M. Marx

Harold C. Mayer

Frank E. McCabe

John J. McCullough, Jr.

Mrs. Robert McKelvy

Mrs. Julian S. Myrick

Donald E. Newhouse

Juan Ortega

Mrs. Meda A. Perotti

Mrs. Cheever Porter

Mrs. D. J. Randall

William M. Redecker

Roger Scudder

Mrs. Rudolf William Selbmann

Philip Sheridan

Alfred Stamm

Mrs. Diego Suarez

Thomas H. Tesauro

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Harold M. Tovell

Mrs. Frederick K. Trask

Ralph W. Wallace

David E. Wilder

Dr. Kenneth R. Woods

John E. Woolley

Fellow

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Irving Bernstein

John Joseph Burke

Mrs. A. J. Clay

Henry Clifford, III

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Dr. Joseph Davis

Dr. Quentin B. Deming

Mrs. Frederick E. Donaldson

Seth Edwards

Louis Epstein

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Miss Pamela Ann Felton

Charles F. Flint

Kelly Fox

Mrs. Allan H. Fry

Ralph Gerstle

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Arthur J. Graffe

Raymond C. Green

Mrs. Leon Guthertz

Mrs. Max Hoffer

Bernie Hutner

Mrs. Umberto Innocenti

T. Herman Jerke

Benjamin Krinitz

Benjamin Kurz

Carl La Motta

George Lautenschlager

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Raymond Liebesman

Frank O. Lindemann

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George MacGovern, Jr.

Ralph J. Menconi

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Eugene J. Miller

James F. Oates, Jr.

John T. Satriale

Mrs. Jeffrey Shannon

Robert Shenker

Mrs. Patricia Sherwood

Mrs. Robert G. Simon

Herbert M. Singer

Mrs. Joseph Skopin

Mrs. Elinore Soja

Dr. Irwin Solomon

Mrs. Frederick T. Staats

Edward Streeter

Dr. Robert Unger

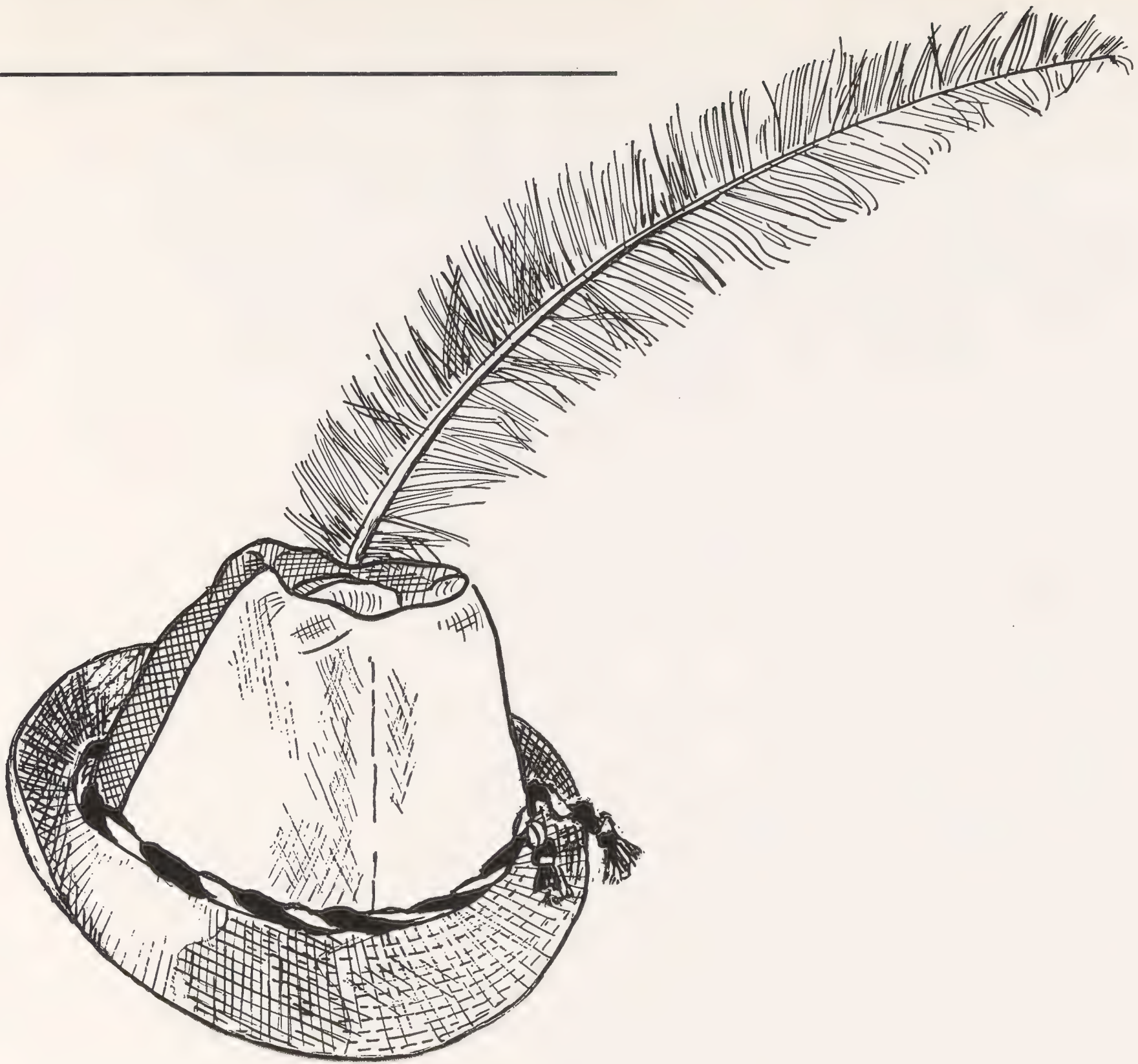
Bruce Van Eerde

Mrs. Mary E. Vence

Edmund S. Wartels

Aaron H. Wolfson

Miss Lynn M. Zadek



A FEATHER IN YOUR CAP

At least 8,640 of our hundreds of thousands* of visitors so far this season equipped themselves for their day in the Zoo with the spectacular ostrich plume hats our souvenir stands are featuring. Jaunty and rakish, they lend a holiday air to any head.

Through a kind of transference, the fine feathers bestow a light and frivolous mood on their young wearers, who are so obviously enjoying the Zoo. They're in high feather, no doubt about it.

Come to think of it, Members should feel happy that their Society runs a Zoo that gives pleasure to so many. Indisputably it's a feather in *their* caps—particularly those Members who extoll the virtues of Membership to their friends. For this leads, of course, to more Members, who in time will merit more feathers, and so on, we hope, *ad infinitum*.

That's the way we build our nest.

* 945,059, April through July 15.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Reprieve of the Trumpeter

THERE REALLY IS NO QUESTION, now, that our country can take real pride in its many accomplishments in wildlife protection. Not so long ago, as time runs, there was ample reason for thinking that we Americans would not wake up until it was too late to become aware of the crises that faced many species of mammals and birds in our continent. There is still a great deal to do in preserving threatened species, but the fact today is that substantial victories have been won and that by and large the whole great cause of wildlife protection has made notable advances. The majority of our fauna is in a fairly secure position.

In the early part of the century it seemed highly doubtful whether such animals as the buffalo, antelope, and Bighorn sheep could survive the onslaughts made upon them primarily for the purpose of obtaining meat, hides and fur. In 1905, for example, there were less than 100 wild buffalo left alive within the continental United States. Today, due to reserves within the National Parks and other game refuges, there are approximately 9,000 — a breeding stock that presumably assures the continuance of this species through the long future. The same condition of long-term preservation holds true for the other so-called "game" animals mentioned above. Presently, however, the continued survival of grizzly bear, wolves, coyotes and other predators is questionable. This, unfortunately, is the case simply because we have not yet evolved a rational system of predator control or, rather, of management of these extremely interesting animals, nor do we realize their value as factors in preventing over-populations of rodents and even deer.

The above observations stem from a happy incident that occurred only last month. Our Zoo received from the U. S. Fish and Wildlife Service a pair of one of the most notable species of water fowl in our country — the Trumpeter Swan. Its breeding habitat is the Rocky Mountain region. Not so long ago it was actually doubtful whether this lovely great, white bird, of wing and water, would survive. A census taken in 1935 indicated that only about 70 remained alive. By careful protection, transplanting to new breeding grounds, and other effective measures, in some of which our Society took part, the numbers of this species in the United States presently total about 700, so that now one is justified in anticipating that they will be with us "forever."

We Americans have been able to accomplish these things because, first, we evidently "care," and, secondly, because we have wonderful means of communication so that the public can be made conscious of crises that threaten species that are on the verge of extinction. Finally, we are constantly improving our knowledge concerning wildlife management.

* * *

In extreme contrast to the favorable development in our own country, serious crises face wildlife in other parts of the earth — especially Africa and Asia. It is in the tradition of our Society to work in areas where the emergency is the greatest. Consequently, at this time, we are concentrating our energies principally in doing everything that we can to help preserve the irreplaceable fauna of Africa, and, to a lesser degree, as in the current Burma project, to help in the cause of wildlife protection in Asia. The situation is a complex one, due in large part to the violent political and social changes that are occurring in these lands, magnified by the fact that there is insufficient recognition among many Africans and Asians that wildlife is one of their most precious heritages, not only for themselves but for the world as a whole. Somehow victory must be won.

Fairfield Osborn

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Etosha Pan

IN THE LARGEST WILDLIF

By JEANIE TREICHEL

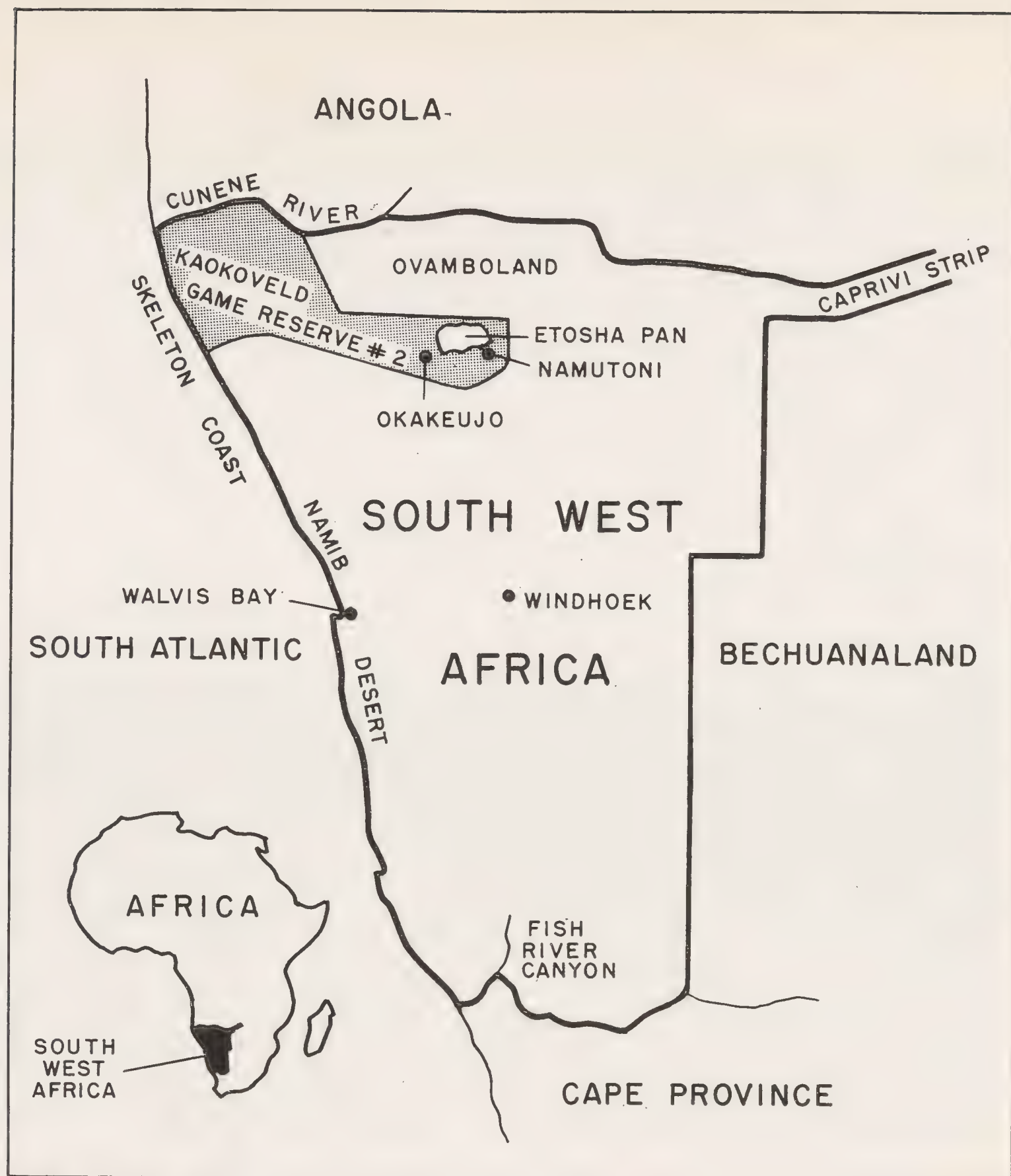
SOUTH WEST AFRICA, the former German colony situated between the Cape Province and Angola, is one of the less frequently visited areas on the African continent. During the latter part of 1957, near the end of our long survey of the national parks and faunal sanctuaries of that continent, we were fortunate in having an opportunity to journey widely in this fascinating land, from the margins of the vast Kalahari along its eastern border with Bechuana-land and the Grand Canyon of the Fish River in the south, to the Namib, an absolute desert along the South Atlantic strand. And along this desert coast, pounded by heavy surf, battered by violent gales and blinding sandstorms and chilled by heavy sea fogs, we observed the fur seal herds and myriads of guano fowl of the Benguela Current — the greatest sea bird spectacle in African waters. For our final safari, however, we reserved the territory's outstanding wildlife sanctuary: Etosha Pan in Game Reserve No. 2, the largest wildlife reserve in the entire world. Game Reserve No. 2 is semi-arid and the Etosha Pan — "pan" being the usual term for a natural depression — appears as a huge salt flat during the dry season and a shallow lake during the rains.

After weeks on the desert tracks and corrugated roads in the far corners of South West, we had returned to Windhoek. This attractive capital city, in the hills near the center of the country, was ablaze with flamboyant bougainvillea, jacaranda and poinciana and proved to be the ideal center for revictualing and vehicle maintenance. Here our Land-Rover safari wagon had to be welded at two critical points, for the effects of rough overland African travel were beginning to be felt.



After obtaining provisions and completing repairs, we headed north over a dusty, washboard route which kept the contents of our Land-Rover rattling vigorously and continuously. But this was one of those magic roads that lead to two of Africa's remaining wilderness areas — Etosha-land and the Kaokoveld. We lunched in the bush country about half way between Windhoek and Etosha, at a waterhole where Wood Hoopoes, European Cuckoos, Cinnamon-breasted Rollers, Go-away Birds and Red-breasted Bushshrikes

RESERVE



Left — Nervous Zebras stampeding at the Homob waterhole, a famous concentration point for a variety of animals. Above — Game Reserve No. 2 in South West Africa, of which the Etosha Pan is a part, is the largest wildlife reserve in the world, more than 26,000 sq. mi.

Photos by George and Jeanie Treichel

made their presence known. As we continued north, caracul sheep and cattle, which have inherited much of the South West landscape, gave way to Steinbok and Greater Kudu. The magnificent Kudu occurs commonly on the ranches south of the reserve and presents something of a hazard, for it springs across the road at dawn and dusk, inadvertently causing accidents. We reached the game reserve gate before sunset and therefore the African game guard waved us on; late arrivals must camp at the gate, for in this

reserve Elephants have the right-of-way on roads after dark. When after a short drive we reached the edge of the vast expanse of Pan under a flaming red-and-orange evening sky, all was silent save the overhead calls of a pair of Stanley Cranes, but in the distance, we could see the herd animals we had journeyed so far to see. Darkness fell quickly as we established our base in a guest hut at Okakeujo, the headquarters camp. Then began the routine evening clean-up, for fine dust, at times lying five inches deep on the roads, had been drawn up into the interior of the car. Only three eggs out of a dozen had been broken on the 300 mile trip from Windhoek, something of a record for the roads traversed!

Early the next morning Mr. B. J. G. de la Bat, the Chief Warden, and his biologist, Dr. R. C. Bigalke, conducted us on a reconnaissance of the



gleaming Pan, the main topographical feature in the eastern part of this huge sanctuary. As we emerged from the bush country and crossed the open grassy plains and sandy tracts fringing the enormous Pan, the country came to life — herds of animals could be seen everywhere. Staggering blue skies, bountiful clouds and intriguing mirages added to this broad sweep of wild, wonderful Africa. The seemingly endless white salt Pan itself actually extends ninety miles from east to west and forty miles from north to south at its broadest points and was first seen by European explorers in 1850. During Tertiary times, Etosha Pan was an interior drainage basin fed by the waters from the Cunene River system which drained the highlands of Angola to the north, but more recent geological disturbances have caused the Cunene to discharge the bulk of its water directly into the Atlantic, thereby cutting the Pan from its major permanent source of water. The result was the shimmering dry salt pan lying before us, one of the two (Mkarikari in Bechuana-land, the other) largest and most impressive sinks on the continent. Only after the occasional exceptionally wet summers in the country to the north has it filled in recent years to appear in all

On the way to the Etosha Pan the road runs through semi-arid country covered by low bush. This is an antelope country and frequently, at dawn or dusk, a magnificent Kudu is likely to dash across the road

its former glory as a great isolated, interior sea.

What makes this area unique? With more than 26,000 square miles, it is the largest wildlife reserve in any country; three times the size of the better known Kruger National Park and actually half the size of England or five times the size of Connecticut. It has some extraordinary waterhole concentrations of Zebra, Wildebeest, Gemsbok and Springbok, and what are believed to be the largest remaining herds of the last two species. In addition, Etosha is one of the finest Greater Kudu areas in Africa and has some of the continent's more impressive large Ostrich flocks. Unquestionably, it contains the foremost wildlife habitat in South West Africa and is one of the truly superior faunal areas on the entire continent. The Kaokoveld area — the more scenic northwestern half bordering the Skeleton Coast and located over 300 miles from the southeastern end — remains one of the wildest and most inaccessible corners in Africa. It is the last place

remaining in all South West for long-term protection of the larger forms: Giraffe, Elephant, and especially Black Rhinoceros, the latter disappearing so rapidly from the African scene.

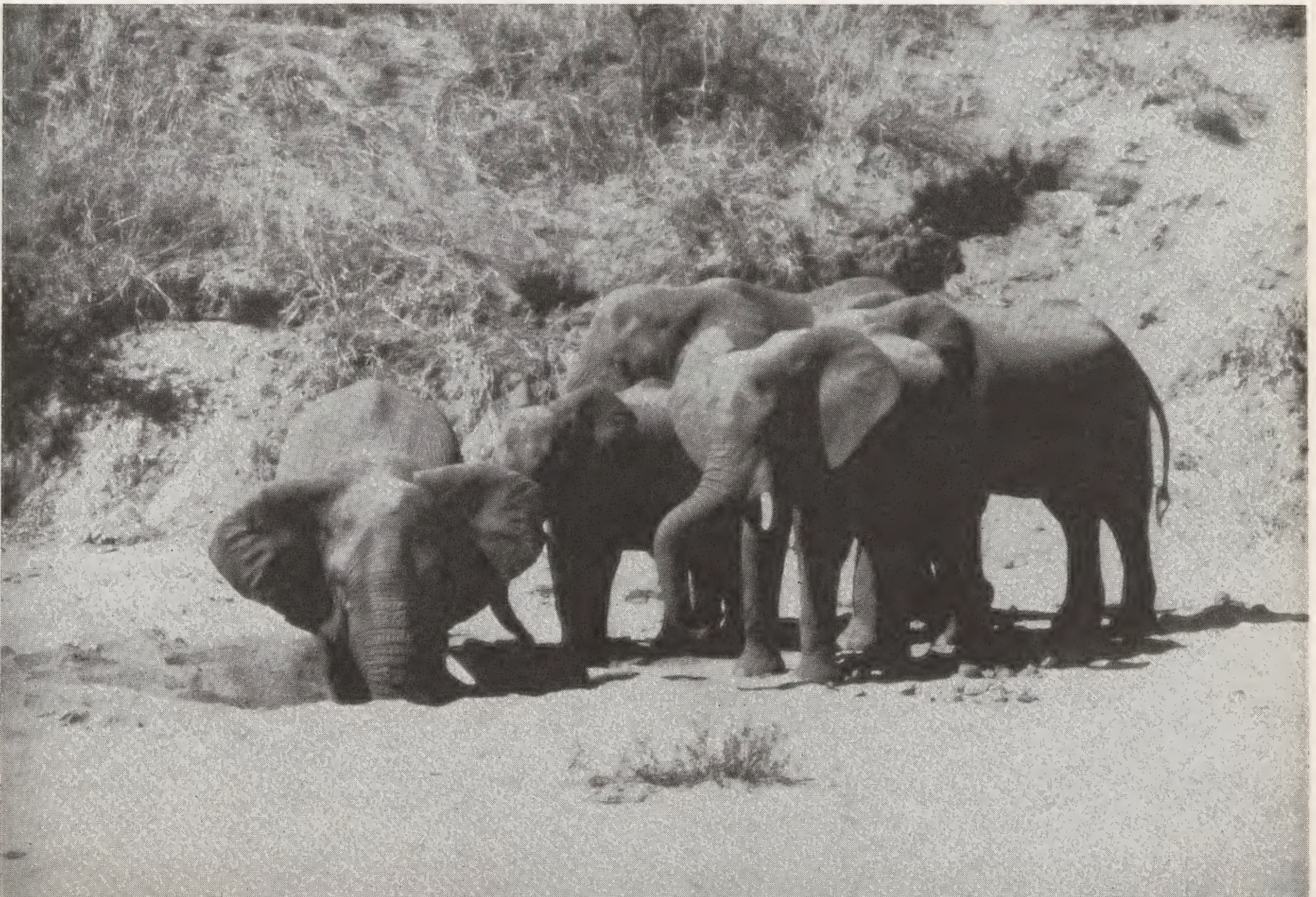
Etosha Pan represents the northern limit of European occupation in South West Africa. At the turn of the century, the German colonial troops established their northernmost frontier outposts at Okakeujo and Namutoni, locations which are presently being used as safari camps. Except for a few wandering Bushmen who were so splendidly adapted to the harsh physical features of this arid environment, no natives were living in the immediate Pan area, but the Germans came into violent conflict with the Ovambo tribes living to the north. The Pan became notorious as an area to be avoided by Europeans, and because the Germans wanted to separate the Ovambo tribesmen of the north from the settled areas farther south, the Pan area was declared the Namutoni Game Reserve in 1907 — one of the earliest reserves in Africa. It was administered by colonial troops and, like many large wildlife sanctuaries in Africa, it had its beginnings as a buffer zone at the edge of European settlement.

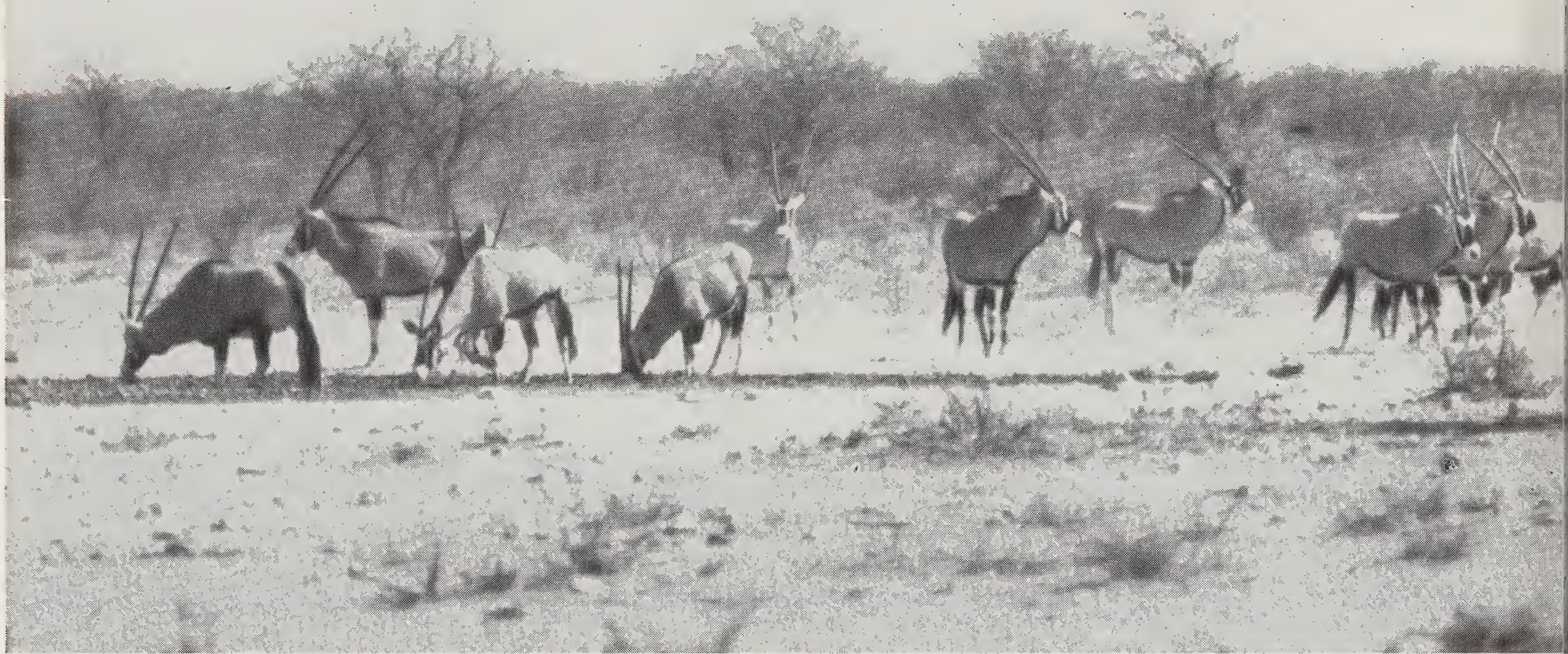
Our October arrival was timed to observe the greatest annual concentrations at the very end of the dry season, the period when water is at a

premium and when animals must trek longer distances for thirst-quenching drinks. Generally, precipitation occurs from November until May with the heaviest rains in February, March and April closing the reserve roads to all travel. During the dry season the herds drink at a number of limestone springs, natural oases along the southern margins of the Pan which serve as focal points for thousands of animals during this critical period.

One morning we drove from Okakeujo to a water point at the edge of the Pan and saw six adult Kudu bulls standing like frozen statues and peering steadfastly at a hidden something, which we later determined to be a sulking Lioness. It was astonishing to see bush-dwelling Kudu in open grassland at this tiniest of waterholes, so far from their normal habitat. Further on we encountered four Lions on a fresh Zebra kill. Three of them, bloody-faced, gave way to the Land-Rover when we approached to examine the kill, but the fourth gently brushed against the door. In the background Jackals paced expectantly, and what appeared to be a string of spaced bushes

Elephants may dig their own waterholes in the dry season, scraping tirelessly with feet and trunk and tusks, often for many hours. Smaller animals also come to drink at such waterholes.





on the horizon was, in reality, a flock of 68 Ostriches. Another visitor had seen a compact flock of 100 the week before.

At the crack of dawn on another morning we journeyed through monotonous, sense-dulling mopane bush to reach the Homob waterhole, a famous concentration point. We parked the Land-Rover in a thicket and waited patiently for three hours in the morning heat. Just as we were about to give up and drive away, a string of Zebra and Wildebeest approached and formed a complete circle around the waterhole and us. For a short hour they continued to file in until the ring around the waterhole was two or three animals deep. Occasionally a Wildebeest would attempt to leave the circle to come to water, but the nervous Zebras (the nourishment of discriminating Lions) kept the herd in a state of tension. Eventually one Zebra deliberately walked toward the water and a line of Wildebeest followed it. Then the entire herd took turns at the water until at one time 700 animals were in view in a circle surrounding our vehicle. The enormous herd of stamping, snorting and grunting Zebra and Wildebeest were later joined by a few rapier-horned Gemsbok and Red Hartebeest. Each time a flock of noisy Quelea Finches or Sandgrouse flew off, or the shutter of our telephoto unit clicked, there was violent stampeding. But the game returned again and again.

The general order of species abundance in this

reserve is approximately Burchell's Zebra, Wildebeest, Springbok, Gemsbok, Greater Kudu, Eland and Red Hartebeest, with the first three being by far the most numerous. The more unusual Hartmann's Mountain Zebra is found in the rugged western Kaokoveld, and the Black-faced Impala occurs near the Cunene River, although a small herd has recently been rediscovered near the Pan. Angola Giraffe and several small but slowly increasing herds of Elephant also occur at some of the quieter waterholes. Of the smaller animals, the Gray Duiker, Damara Dik Dik and Steinbok are present, as are Aardvark, Warthog, Cheetah, Spotted Hyaena, Aardwolf, Delalande's Fox and the extremely abundant Black-backed Jackal. Rarely seen are the Leopard, Brown Hyaena, Hunting Dog and Cape Fox.

One of the feature attractions near the Oka-keujo or western camp is the Leeubron waterhole, for here a rather large pride of Lions is fed artificially twice weekly. Some years ago, so the story goes, a lone Lioness bore six cubs and attempted to rear them. Left to fend for herself, several of the cubs might have died, so the authorities decided to assist her in feeding the unusually large family. The practice has never been stopped and the entire bush comes alive with violence and excitement at dusk twice each week. Later generations of Lions come in not for the kill, but for an easy Wildebeest or Zebra feast. The demonstration, of course, thrills most visitors but, like

Left — Gemsbok thrive in the dry season, for surface water is not necessary to them; they can get moisture from roots, tubers and the cucumber-like tsama melon.

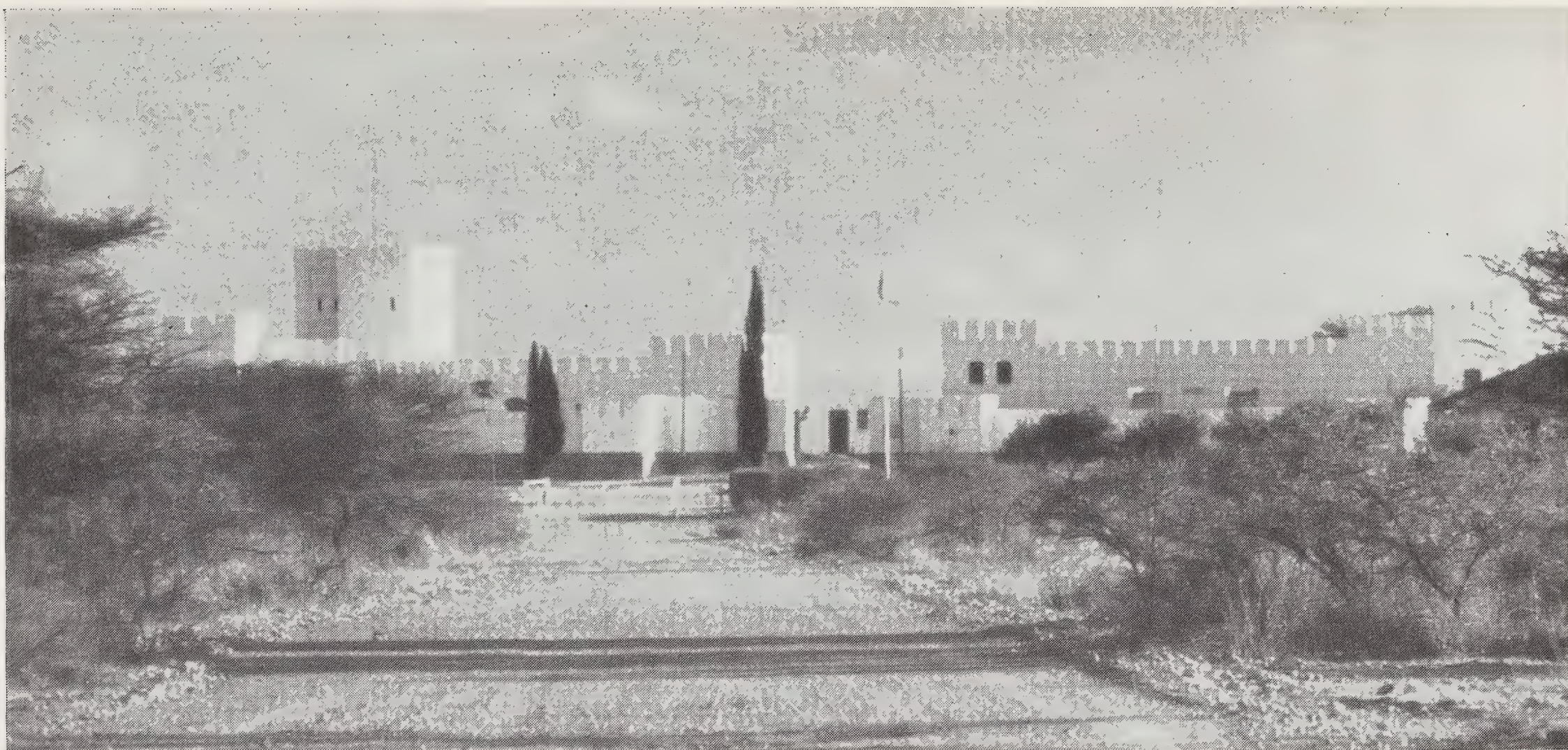
Right — A few minutes after this photograph was taken, the Lioness left the shade and began to stalk her day's meal. Females do most of the actual hunting.

Below — The Angola race of the Giraffe is found in some parts of the Etosha Pan. It is under protection now, but at one time it was shot mostly for its hide.



the former grizzly feeds at Yellowstone, is an unsound biological procedure. Between the two World Wars when the reserve was hardly administered as such, there was much poisoning, trapping and shooting of Lions and other predators in the Pan area, and this still continues on recently established livestock ranches near the southern boundary of the reserve; as a result, Lions have become uncommon over much of the area.

Poaching is not presently a serious factor in the reserve for there are few conflicting native interests. Although small numbers of wandering Bushmen take a small toll of wildlife, it can be said that they live *with* the wildlife as they always have. In a sense, they are a part of the natural fauna. These hearty, element-gnarled people have survived in this severe environment by exploiting a great number of herbs and roots; Ostrich meat, hide and especially eggs; Gemsbok and other smaller meat animals. In a vast area lacking perennial surface waters, they have learned, like the clever Gemsbok, to obtain moisture from succulent plants. For another source of water, they have also learned to squeeze the precious moisture-laden contents of the Gemsbok's stomach into skin-lined pits and Ostrich egg containers. One Bushman whom we met was considered to be an extremely clever hunter for he searched for young birds of prey and tied them



Namutoni Fort was built by the German military government around the turn of the century. Now, from its tower at dawn and dusk, antelope herds may be seen on the game flats.

to their nests. Then as the parent birds flew hares and rodents in to the young, the Bushman feasted on a share of the catch.

Eighty miles east of Okakeujo we found one of the most attractive and agreeable safari camps in Africa, Namutoni Fort. It was also established by the German military government at the turn of the century in order to keep the unconquered Ovambo tribesmen of the north at bay, and to control the disastrous scourge of rinderpest which was then raging south in Africa. No one could ever forget a visit to this shimmering white fort, which has been reconstructed around a courtyard. From its lookout tower at dawn and dusk one can reconnoiter the sweeping game flats for herds. The hoofs of tens of thousands of animals have beaten a network of well-worn game trails around the fort.

From the solitude of the Namutoni Fort, a simple track leads north to Ovamboland, one of Africa's untouched native reserves which can only be entered by special government permit. Enroute, the Adoni Flats are passed, and here we observed the largest concentration of plains animals outside of East Africa. The large herds of running, pronking Springbok were a feature of this area as were the tens of thousands of colorful and noisy waterbirds, including White-bellied

Storks, Greater and Lesser Flamingos, Egyptian Geese, Red-billed and White-faced Tree Ducks, pelicans, gulls and terns.

And it was near Namutoni that we witnessed the abrupt and dramatic finale of the long dry season. On the final morning of that period, more than 450 Greater Kudu were counted at one waterhole in the bush country — perhaps a record that cannot be equalled anywhere else in Africa. Later in the afternoon magnificent purple thunderheads built up overhead and the next day pools were scattered everywhere; yesterday's roads of choking dust became today's rivers of mud. Game concentrations dispersed and following the commencement of the rains our best Kudu count at one waterhole was reduced to 37.

As the time drew near to leave this reserve — the wildest and most impressive feature of its kind on the southern part of the African continent — we extended our thanks to the Government Secretariat of South West Africa for making the visit pleasant and possible. In recent years, the Administration has taken a number of commendably positive steps to manage the immediate environs of the Etosha Pan intelligently. It is sincerely to be hoped that effective Warden supervision will soon be established in the rugged grandeur of the northwest Kaokoveld as well, for the entire block of Game Reserve No. 2 is a priceless possession which all South West Africans and their guests will learn to appreciate even more as the pace of development hastens and primeval Africa disappears.

CONEY ISLAND SEA-URCHINS

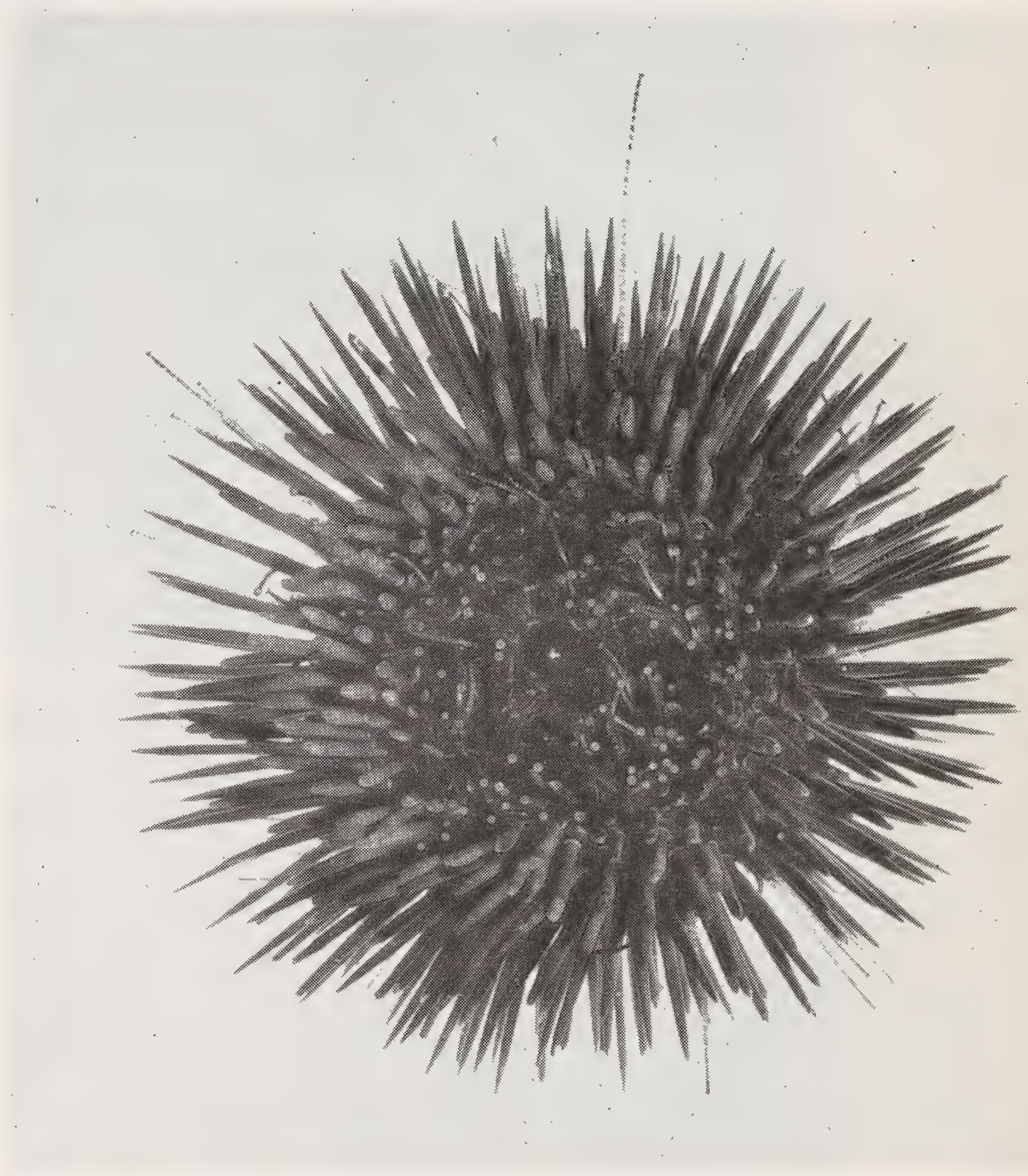
By SOPHIE JAKOWSKA

UNLIKE MOST OTHER BIOLOGICAL INSTITUTIONS, marine laboratories are largely dependent on the local fauna for experimental subjects. Rats, guinea-pigs, fruit flies and a host of other laboratory animals can easily be bred in captivity, but very few sea creatures can. The great marine biological stations of the world, Plymouth, Naples, Woods Hole and the rest, made their reputations on the animals they collected from nearby sea and shore. The Aquarium's new Department of Marine Biochemistry and Ecology is fortunate in having a variety of marine organisms just outside the laboratory at Coney Island, and a few minutes' ride on one of the superhighways close by makes hundreds more available.

But even Dr. Ross F. Nigrelli, who directs the new Department, did not anticipate all the advantages of having a marine laboratory in New York. Not until last summer did he realize that there were colonies of the Purple Sea-urchin, *Arbacia punctulata*, close at hand. This spine-studded relative of the starfish and sea-cucumber is perhaps the most useful of all the marine laboratory animals, and consequently it has the distinction of being one of the most sought after, having become a rarity at the very place that made it famous.

The sea-urchin has been an important research tool since the last decade of the 19th Century, for it was in 1892 that Jacques Loeb, and 1893 that Thomas Hunt Morgan, performed the earliest experiments on the eggs of *Arbacia punctulata*. Woods Hole — then a small fishing village girt with a rich marine flora and fauna — had been the scene of their research, for it was here that some of our greatest biologists prepared, with their classical descriptive studies, the ground for future experimentation.

As Ethel Browne Harvey comments in her monograph on "The American *Arbacia* and Other



From the underside, the tube feet of a Purple Sea-urchin may be seen as it walks up a glass side of its tank in the Aquarium. Some species move about by the action of their hard spines.

Sea Urchins," the egg of the sea-urchin is an ideal cell, useful in a great variety of experimental studies. Its spherical shape makes changes easy to detect. It is relatively simple in structure. It is resistant to moderate changes in the composition of sea water as well as fluctuations of temperature and pressure — and at the same time it is so sensitive that it responds in special ways to the presence of extremely minute amounts of poisons in its environment. This, for example, has made it useful in testing drugs concerned with the development and arrest of cancerous growths. As an indication of its sensitivity, a British scien-

tist working at the Plymouth Marine Laboratory was able to demonstrate biological differences in sea water taken from different locations by employing a European species of sea-urchin. The animals detected differences in chemical composition so minute that no chemical tests now known could detect them.

The early workers on *Arbacia* were primarily concerned with events in the development of the eggs and changes on the cellular level — in other words, the embryology and cytology of the Purple Sea-urchin, both descriptive and experimental. But the more that was learned about this lowly creature, the more it was in demand for research in other fields. Students of physiology and biochemistry turned to the sea-urchin and called for great and ever-greater numbers for experimentation.

What happened is exactly what this present conservation-minded generation would expect. From about 1874 to 1919, Purple Sea-urchins were found in many populous colonies in Buzzards Bay and Vineyard Sound, but after 1919 it was noticed that they were becoming increasingly hard to collect. J. S. Rankin, Jr., made a survey of the whole Woods Hole area in the summer of 1950 and in six weeks found only *one* single *Arbacia*. Toward the end of the summer he did come across a very small bed in Martha's Vineyard, but the good old days were over.

The story is there for anyone to read in the collecting records of the Marine Biological Laboratory: 70,000 sea-urchins collected in 1933 and 1934; 45,000 collected in 1947, of which 600 were delivered daily to eighteen investigators. There have been a number of attempts to explain the cause of *Arbacia*'s disappearance, but over-collecting alone would account for it.

This unfortunate experience should teach an important lesson: it is time to correlate the needs of research with the conservation of our marine resources. The extinction of *any* plant or animal is a literally irreparable loss, but the wiping out of the sea-urchin population on the Atlantic coast would be a great and immediate blow to experimental biology. Conservation of the remaining sea-urchin beds *must* be enforced.

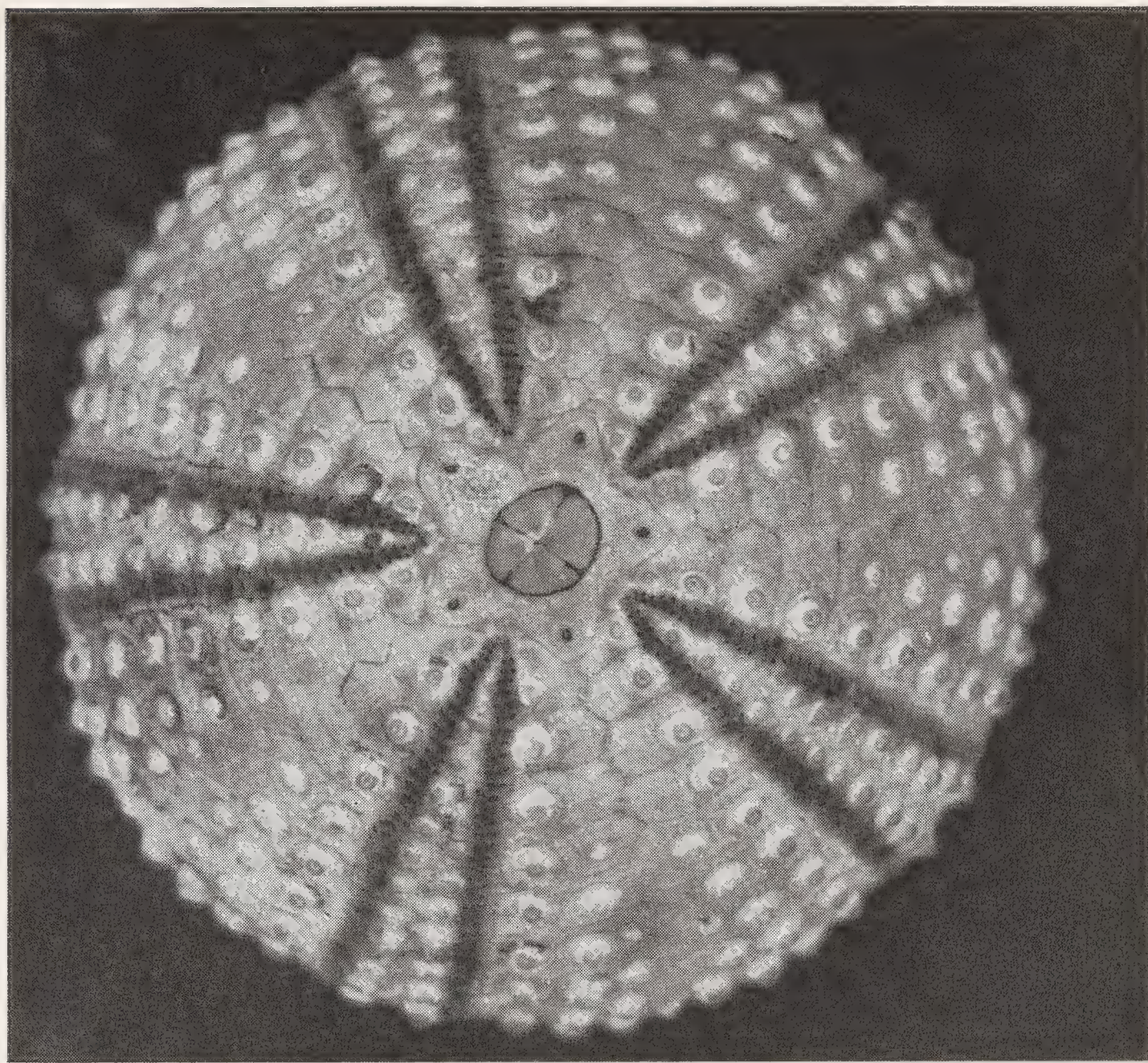
We are, in fact, practicing what we preach. Last summer Dr. Nigrelli discovered a number of untapped beds of Purple Sea-urchins in the

New York Bight, at the very sea door of the Aquarium. Now they are being tapped — but sparingly and with due consideration for the animals' reproductive potential. Experimentation has been going on for months in the Aquarium's laboratory, but only two dozen sea-urchins were required for more than a hundred tests involving nearly two hundred thousand baby sea-urchins raised from eggs.

The research involving the Department of Marine Biochemistry and Ecology and sea-urchins is in itself interesting. One phase of it was carried out by George D. Ruggieri, S.J., a predoctoral graduate student of St. Louis University. As an embryologist, Mr. Ruggieri was concerned with the development of certain marine animals and he applied for a table in the Department because of the opportunity it offered to work with Holothurin, a substance described and named by Dr. Nigrelli in 1952. This material from the Cuvierian organ of the Bahamian sea-cucumber, *Actinopyga agassizi*, is an unusual chemical compound and produces a variety of spectacular effects on biological systems, from protozoans to mammals. We have evidence that it affects cell division, growth and regeneration in animals upon which it has been used experimentally, but we know very little about its action under natural conditions, when it comes in contact with plankton, for instance.

Plankton, that infinitely varied host of minute floating organisms that form the base of the food chain in the sea, is rich in nourishing substances: proteins, fats, carbohydrates, vitamins — and growth-inhibiting ones like antibiotics as well. Some of these are confined to the bodies of the organisms; others are found in the water also. Since the fate of so many creatures of immediate economic importance to man depends upon the available plankton, we should press forward with investigations of it in all its phases. Holothurin is an example of one of the many natural substances that are capable of influencing the productivity of the sea. The developing eggs and larvae of the sea-urchin are part of the plankton; not until they assume the adult form do young sea-urchins settle down on the bottom. In the laboratory of the new Department of Marine Biochemistry and Ecology, it has been possible to bring together all the elements needed in an in-

The test, or skeleton, of a Purple Sea-urchin, often found on the seashore from Cape Cod to the Gulf of Mexico. It may be as much as 2 inches in diameter and shows its five-sided plan.



teresting piece of research — Holothurin, sea-urchins, plankton, sea water on tap.

Mr. Ruggieri's work was originally planned only for the summer months, the normal breeding season of the Purple Sea-urchin, but conditions in the laboratory proved so favorable that *Arbacia punctulata* was coaxed into supplying eggs and sperms long after the boardwalk crowds departed from Coney Island and the first snows fell on the empty parking fields. At Woods Hole, sea-urchins had been induced to lay eggs as late as January under rather exceptional conditions, but we have stretched the season even longer and have been getting eggs well into February.

The cooperation of our sea-urchins in egg-production has not been entirely voluntary; in fact, it has literally been a shock to them, for Mr. Ruggieri employed the electrical stimulation technique described by Dr. Harvey. In this method, two electrodes are applied to the animal's body while it lies in a dish of sea water. An alternating current of about 7 volts is passed through the animal and the smooth muscle cells of the walls of the reproductive organs contract and eggs or sperms are expelled. Other methods of obtaining eggs out of season frequently require sacrificing the sea-urchins or emptying their reproductive organs completely, but the electrical stimulation procedure is not only humane but is

also practical from the viewpoint of conservation and repeated availability of the donor.

Looking at adult sea-urchins, "grazing" lazily over rocky or shelly bottoms overgrown with algae, it is hard to believe that they were barely $\frac{1}{250}$ th of an inch in diameter and three to four months of age when they first assumed their pin-cushion physiognomy. Prior to this, they looked entirely different from their parents. Mr. Ruggieri's work dealt with the developing sea-urchin up to the pluteus stage, which is reached 24 to 48 hours after fertilization of the egg, depending on the temperature, when the little organism resembles a microscopically small tricornered hat with hard supporting structures of calcareous spicules. Many thousands of eggs have been brought to the pluteus stage in the Aquarium — at the expense of about two dozen sea-urchins.

The observations Mr. Ruggieri has made and the extent and direction of our sea-urchins' contribution to science will have to await the publication of Mr. Ruggieri's doctoral thesis. It can be said, however, that the modified course of development exhibited by sea-urchin eggs under the influence of Holothurin proves this substance to be of even greater biological interest than was originally expected and that the scientific debut of the Coney Island Purple Sea-urchin has been a great success.

Rattles

and Hisses

and Rasping Scales

By HERNDON G. DOWLING

ASK ANYONE what sounds snakes are capable of making and you are likely to get the prompt answer that, "Well, rattlesnakes rattle . . . and don't some snakes make a hissing sound?" They do, but the answer covers only two of the three known snake sounds. The third is an unusual one, a coarse rasping reminiscent of grasshoppers and katydids, and we have heard it a few times in a pair of 2-foot-long, tannish-brown Saw-scaled Vipers, *Echis carinata*, that have just come to us from southeastern Russia.

Although most people think of a rattle as the most typical snake sound, merely because the rattlesnakes have been well publicized and their name describes their habits, hissing is actually the most common reptilian sound. Hissing snakes share that ability with turtles and crocodilians and lizards — and, for that matter, with opossums.

The vipers of the world, all of which are venomous, are the only group of snakes that produce all three sounds: rattling, hissing and rasping. Some of the non-venomous snakes, however, have developed hissing apparatus that exceeds anything the vipers possess. The bullsnakes (*Pituophis*) of North America would surely take the prize in any hissing contest, for not only have they evolved an extra-sized lung (most snakes have only a single lung), but they also possess a little piece of cartilage in front of the glottis where the air is expelled. This cartilage can be erected into the stream of escaping air and increases the sound, much as a card does when it is held edgewise in a jet of air.

The vipers would not be very far behind in a hissing contest, nevertheless. Many of them, the Old World vipers in particular, are experts. Their

hissing varies both in strength and duration — from the short, sneeze-like hiss of the Northern Viper (*Vipera berus*) to the long, steam-valve-like noise of Russell's Viper (*Vipera russelli*) and the African Puff Adder, *Bitis arietans*.

The use of the tail to make a sound is virtually but not entirely confined to snakes; one can think of the warning slap a beaver gives to the water with his tail, and the rustling of the quills on a porcupine's tail. Among snakes, the sound is not peculiar to rattlesnakes. Many of our North American harmless snakes vibrate their tails rapidly when they are excited or alarmed and they can make quite a considerable noise on a hard surface or in a bed of dry leaves. It is, indeed, a kind of rattle-made-without-a-rattle. The king-snakes (*Lampropeltis*), the racers (*Coluber*) and the ratsnakes (*Elaphe*) are especially notable in this regard.

Even among the venomous snakes, it is not necessary to have a rattle in order to do a pretty fair job of sound-making. Most of the venomous snakes of North America shake their tails. Both the Copperhead (*Agkistrodon contortrix*) and the Cottonmouth (*Agkistrodon piscivorous*) have this habit, although there is no obvious advantage to the snake and no specialized tail structure is present. Some of the vipers of the American tropics (*Bothrops*) do have an enlarged scale at the tip of the tail that may be a specialization toward better tail-rattling, but only the rattlesnakes (genera *Sistrurus* and *Crotalus*) have a real tail-rattle.

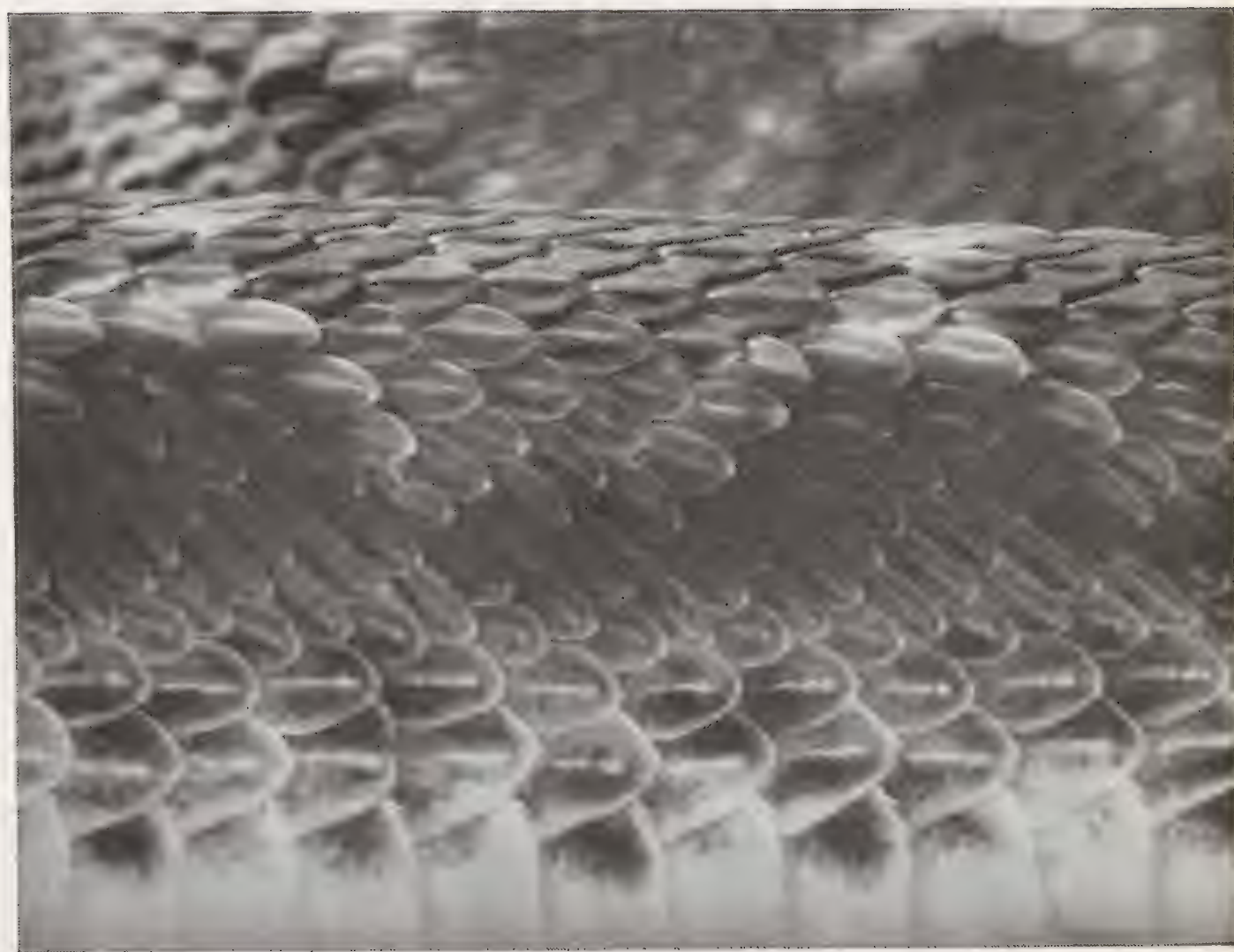
The amount of noise that a rattle makes is, of course, dependent on its size. Small rattlesnakes usually have small rattles, but even some of the larger species have smaller rattles than would be



Above — Even at some distance, the rough scales of the Saw-scaled Viper are noticeable. Rasping sound is made when the snake rubs body loops together. Right — Closeup of scales.

expected. The extremes in rattle-noise are probably that of the Pigmy Rattlesnake (*Sistrurus miliarius*) and that of an Eastern Diamondback Rattlesnake (*Crotalus adamanteus*). The Pigmy rattler sounds very much like the “ticking” of a small grasshopper and can be heard only faintly at a distance of six feet. In contrast, a sufficiently irritated Eastern Diamondback (and most of them seem to be easily irritated) can be heard as a continuous raspy clatter from a distance of a hundred feet or more.

The method of producing sound by rasping one scale over the other appears to be completely unknown to reptiles except in *Echis*, the genus which includes the Saw-scaled Viper, and in the odd, egg-eating colubrid snake *Dasypeltis*. These two snakes (and another viperid genus, *Cerastes*,



closely related to *Echis*) have some of the lateral rows of scales set at an angle to the others. The scales of these rows have heavy keels with serrations on them, suggestive of the stridulating organs of the orthopterans. By throwing the body into close, S-shaped loops and moving the loops

against one another, these serrate scales are rubbed across one another. At the same time extra air is taken into the lung and the body is inflated as a drum-like resonating chamber. Even with all of this specialization and preparation, however, the method is obviously inefficient. All that is produced is a hissing sound that is almost inaudible to the human ear at a distance of five feet. Nevertheless, we must give these snakes credit for evolving a sound-producing method that is as unusual as that perfected by the rattlesnakes, although not nearly so effective from the human viewpoint.

All of these methods of sound production indulged in by vipers brings up an interesting question. Why produce sound at all? The question is doubly interesting since it has been demonstrated (and confirmed) that snakes are totally deaf to airborne sound waves. If other snakes cannot hear it, it obviously cannot be very useful in courtship activities or in warning other snakes. In addition, observation seems to bear out the fact (in opposition to legend) that any of these snake sounds tend to frighten away the common prey animals. Thus, the only possible advantage to the snake would seem to be in some form of defense.

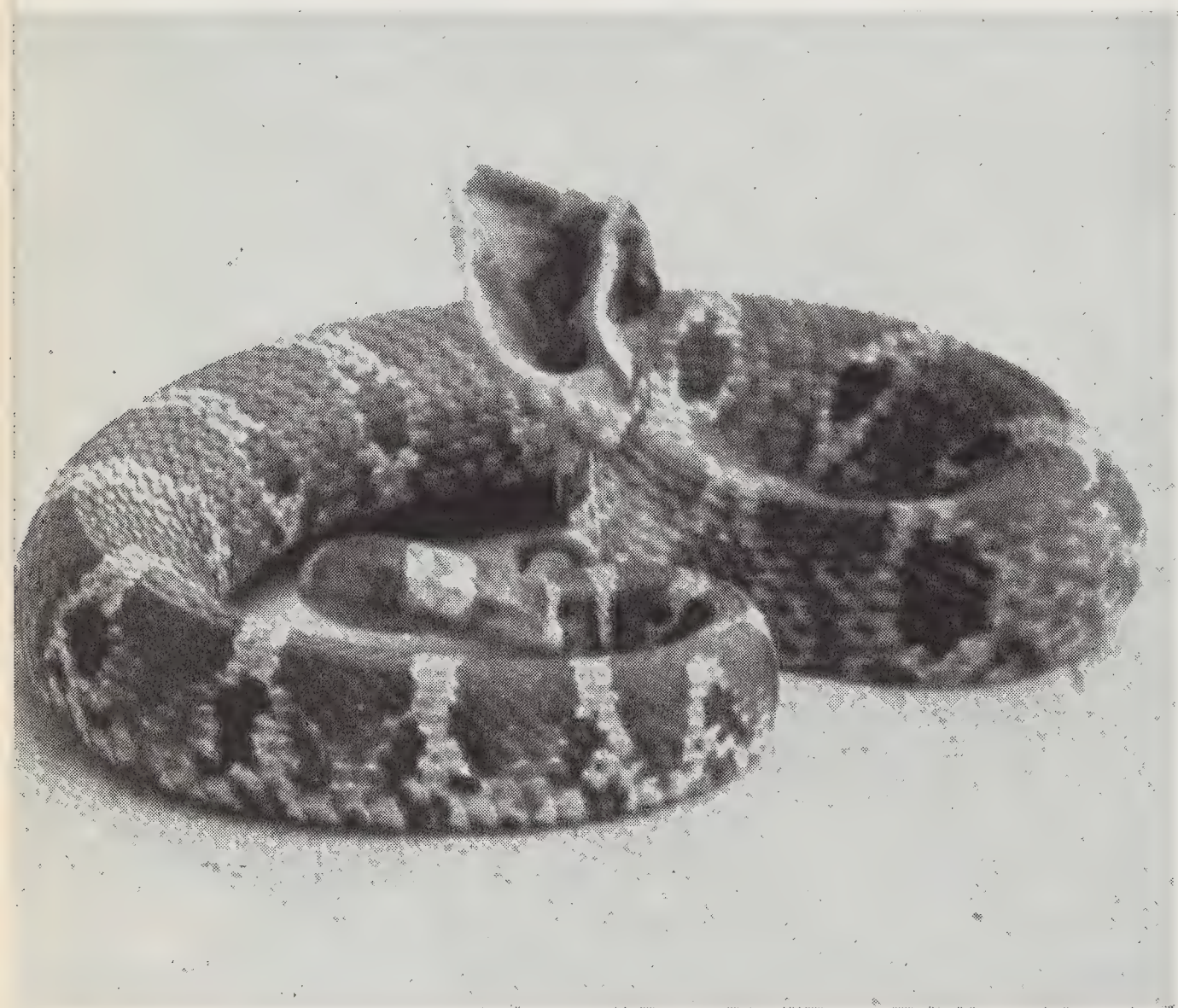
And why should a noise-making method of de-



The best-known reptile sound — even though comparatively few people may have heard it — is a rattlesnake's dry, harsh, whirring rattle. An Eastern Diamondback can be heard 100 ft.

fense be such an advantage to the vipers — who have the most highly perfected venom apparatus known among snakes? Fortunately, we do not have to rely entirely on our own ideas for the answer to this question. The late Thomas Barbour of Harvard University pointed out long ago that for rattlesnakes the advantage must be in not being stepped on by the large mammals of their region. This is of especial advantage to snakes living in deserts or in other relatively barren areas. Not only does this line of reasoning fit the rattlesnakes, most of whose members are found in the arid West, but the Saw-scales and more specialized hissers of the Old World as well. These latter kinds are found mainly in the desert and arid plains regions of western Asia and northern and central Africa.

Thus, practically all of the specialized noise-making vipers do live in regions with little cover — regions which are also inhabited by large mammals such as bison, antelope and wild cattle. While the bite of the snake might be sufficient to kill such an animal, and certainly would hurt it badly, the animal might not react in time to avoid stepping on the snake. This, then, seems to be the basis for noise-making in the vipers of the world — to give a warning that is effective in preventing large mammals from stepping on the snake.



Hissing is a less familiar sound than rattling but the Common Hog-nosed Snake is quite accomplished as a hisser. This one, while hissing, is about to turn over and "play 'possum."

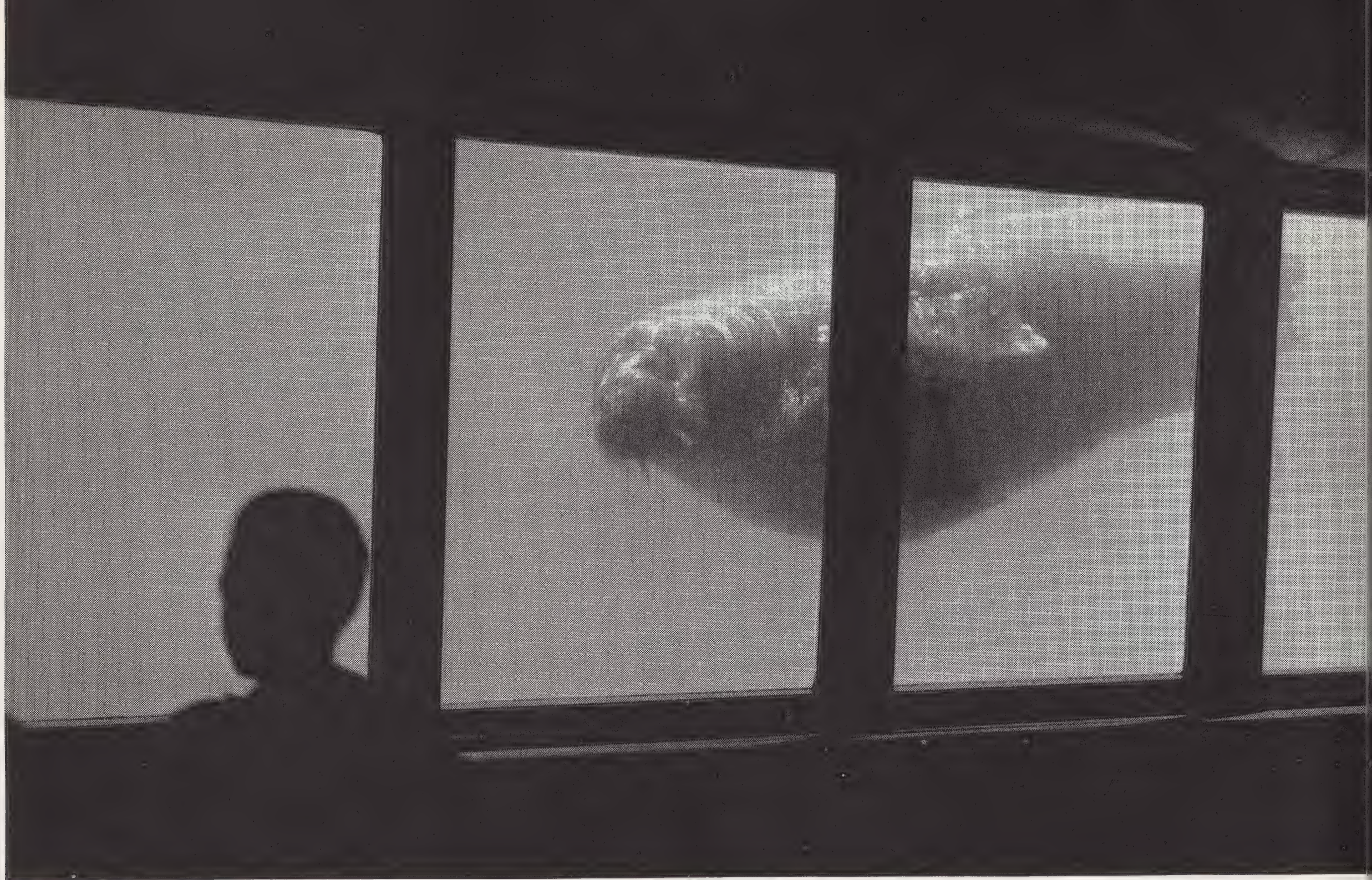
Photo by Charles M. Bogert

ZOO PICTURE PAGES

PHOTOGRAPHS BY SAM DUNTON

The usual practice is for the man to feed the bird, but this **BLACK-WATTLED HORNBILL** has taken a great liking for Summer Keeper **FRED HONER** and at feeding time she reverses the procedure and offers grapes to him. During their courtship period, Hornbills often feed each other. If grapes are in plentiful supply, the Black-wattled female is likely to offer one to her feathered mate before she tries to feed her keeper.





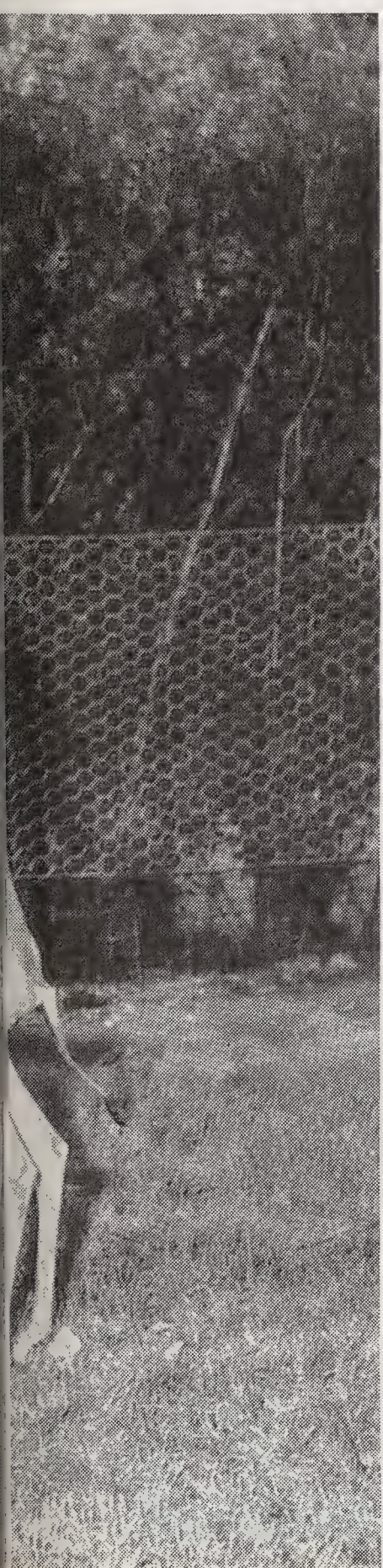
OLAF, the **ATLANTIC WALRUS** at the Aquarium, is nearly 3½ years old now and his baby tusks — barely visible when he arrived in the autumn of 1956 — are still slender but about 4 inches long. Olaf dominates the big Oceanic Tank at the Aquarium by sheer size, seldom annoying the Seals and Sealions.

Our pair of **GERENUKS**, long-necked and slender-legged antelopes from Africa, was completed on July 18 when we received a young female. The male had come to us in the fall of 1957. Surprisingly, the female was not timid. She immediately took to her keeper, **NEIL DAPOLITE**, and readily comes to him. Both Gerenuks take food held high — as they would do when feeding in the African bush — but the male is somewhat more wary than he used to be.





Best show in the Zoo during the hot summer weather has been the young **CHIMPANZEES**, the "Four Little Women," who have learned the joys of a swimming pool. Their usual procedure is to take a quick shower under the spray from a hose, and then to make a series of leaps into the shallow water at the bottom of their enclosure.



LESSER KUDUS are surely among the loveliest and most graceful of all the African antelopes. Now we have a pair and they may be seen in two of the large, outdoor corrals at the south end of the Antelope House, next to a corral that is the home of their relative, a huge Greater Kudu with magnificent horns.



UNIQUE TO AUSTRALIA

THE PINK-EARED DUCK

By JOHN WARHAM

Melbourne, Australia

PEOPLE in America and Europe tend to envisage Australia's fauna in terms of strange animals such as the monotremes, marsupials and bower birds which have no near relatives elsewhere. Yet Australia has many "conventional" animals too — more than fifty kinds of rats and mice, for instance — and the majority of her birds have closely allied forms in other parts of the world. Nevertheless, even in familiar bird groups evolution in conjunction with geographical isolation has sometimes had unusual end-products. Thus among wildfowl we find aberrant species like the Pied and Cape Barren Geese. The Pink-eared Duck might well be included here, for its correct position in the family Anatidae is still undetermined. Indeed, it was only three years ago that the pattern of the nestling — an important consideration for taxonomic purposes — was described.

So far, I believe, the Pink-eared Duck has never been exhibited outside Australia, and it is to be hoped that one of these days the New York Zoological Society will be able to acquire the species.

It is a handsome bird and hardly deserves a name as ugly as *Malacorhynchus membranaceus*! Small, about the size of a Teal and weighing only nine ounces, it is usually spared by discriminating sportsmen who take bigger and less confiding birds for the pot. Back and wings are brown with the creamy underparts finely barred with black. This striped patterning accounts for the title of "Zebra Duck" used in some parts of Australia, but the official name derives from the tiny patches of pink feathers that lie on either side of the head just behind the brown triangles around the eyes. The sexes look alike. The oddest thing

about the Pink-ear is its bill. This is almost disproportionately long, spatulate, with the edges of the upper mandibles extending downwards to form two skinny curtains broadening towards the tip to form a pair of membranous flaps.

Pink-eared Ducks are filter feeders. The inner edges of their beaks carry stiff bony combs or lamellae and in feeding they cruise along with their bills submerged, sieving minute animal life from the water. The birds are not rarities but they are certainly among the least known of Australian wildfowl. Theirs is a mainly inland distribution and they are likely to be met with in districts with lakes, swamps and flooded country whose waters abound in water fleas and other minute crustaceans. Dry during the summer, many such swamps become filled with the winter rains and under the influence of sunshine the animal life revives and multiplies abundantly. Pink-ears and other birds such as avocets and spoonbills that depend on such life for food can then nest in safety, since their young will be hatched when the food supply during their first critical days is assured.

Should the rains come out of season, the ducks may breed out of season too. Conversely, if the rains fail, they will not nest at all. In exceptional years Pink-ears may be locally abundant, every hole may house a nest, and brood after brood may be reared from each. These conditions obtained in parts of New South Wales during 1956 when one observer found 60 eggs in a single hole. All the lower ones were addled and the stench pouring from the hole was almost unbearable. Obviously the competition for nesting sites was intense.

The Pink-eared Duck builds its nest in a hole in a tree or — as here — in the crotch of a tree growing in a swamp. The deep cushion of down, plucked from the female's breast, is good as insulation.





The birds I recently studied were living in a series of shallow salt lakes about fifty miles from the sea in the coastal plain of Western Australia. Several nests were found but the one most convenient for observation was cradled in the crotch of a Paper-bark tree and was only four feet from the water. By late November when my observations were made, the tepid waters teemed with minute animals, some parts being of an almost soup-like consistency owing to their abundance. The numerous broods of ducklings present must have had all the food they could possibly need.

Wildfowl are notoriously timid creatures when nesting but here Pink-ears differ from most other Anatidae. They are generally easily approached and when my blinds were complete and I put them to use I soon discovered that the nesting pairs were already quite reconciled to the strange contraptions.

Normally I would enter the blind about an hour after dawn, staying there until mid-afternoon. The weather was not good or I would have undertaken even longer watches. As it was,

thunderstorms rolled up nearly every evening, accompanied by torrential rain. These storms forced me to leave before they broke, not because I shirked discomfort, but to avoid putting the birds off their nests in the rain and thereby endangering the eggs through chilling.

Before my first watch I paddled around in a dinghy, attempting to shift the Pink-ears from the neighborhood, hoping in this way that I might slip into the blind unobserved. This idea did not work, for the ducks refused to go far away, but fortunately once I was hidden they seemed to forget all about me.

I had only five minutes to wait before the pair re-appeared, drifting slowly towards the nesting tree. Soon they were floating quietly beneath it. One bird had its bill raised and peered intently at the nest, the other seemed more relaxed and its head was withdrawn into its shoulders. As they swam around I caught the sound of a soft whispering chorus, a series of peculiar purring notes which I was later to find the invariable accompaniment of the birds' approach to the nesting

tree. I could never tell whether both or only one was responsible.

Nor could I tell whether both or only one of them covered the eggs. Duck and drake proved indistinguishable, so that I could not be sure whether they followed the normal custom of wild-fowl, the duck alone incubating. It would have been very instructive had I been able to mark one bird from each pair (perhaps by fixing a small brush charged with paint above the eggs) so that I could have recognized each member at a glance, but I lacked the time to do this. So in the following account, when I write of the duck I refer to the bird at the nest; conceivably this could sometimes have been the drake.

The blind from which the author observed the ducks was within a few feet of the Paper-bark tree; the nest was 4 ft. above water.

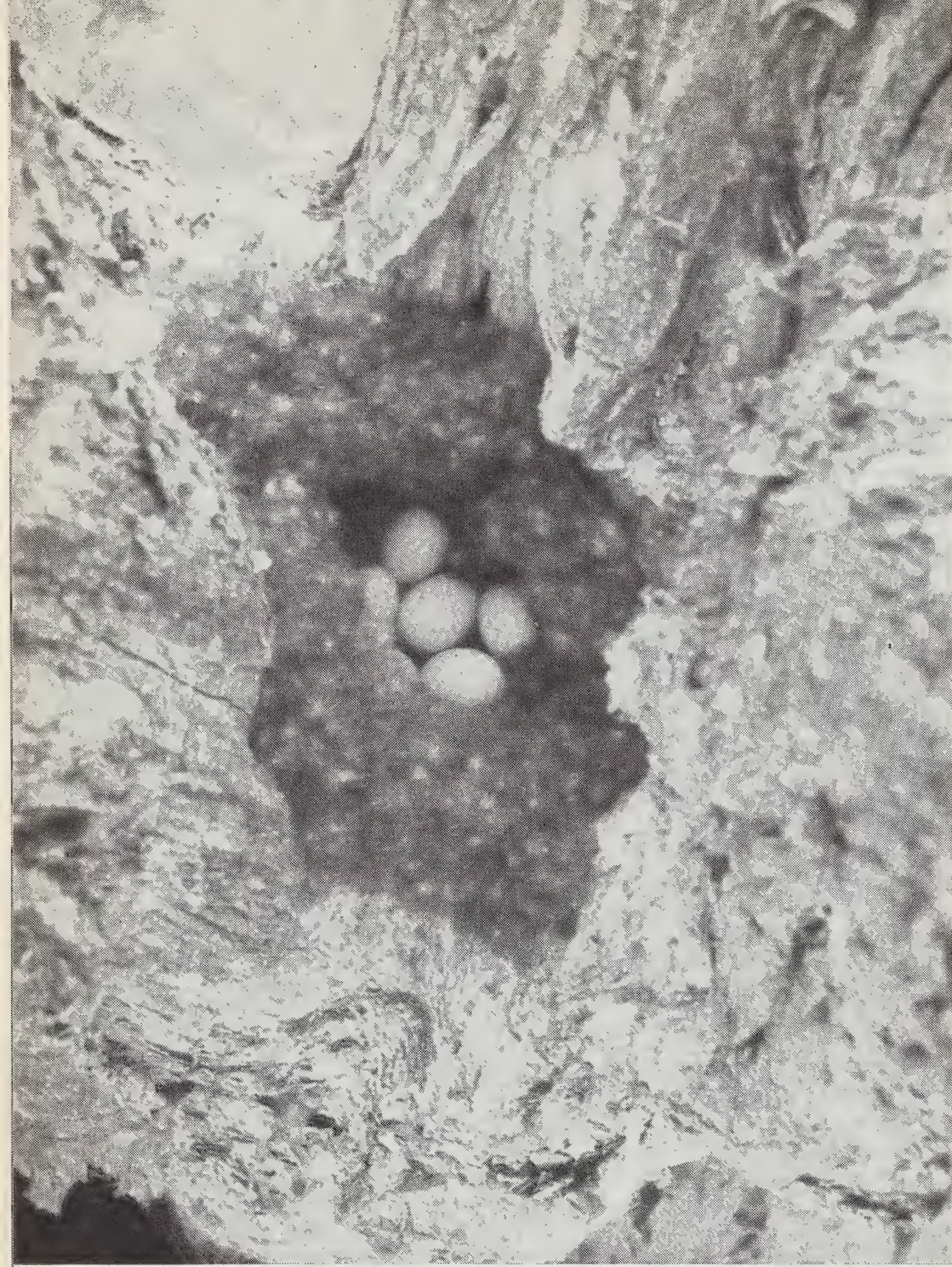
The open crotch made observation easy and the bird quickly became reconciled to the presence of the blind and movement.

After paddling around the tree for a few minutes, the bird with the uplifted bill suddenly sprang up towards the nest, voicing as she did so a fluting "tew-ee" — the normal flight call of the species. She had to make several further attempts before she succeeded in getting a foothold in the crotch. Later I was to find that a bird nesting on the far side of the swamp, in a Casuarina, also had some difficulty in reaching her hole, for the small entrance was a tight fit and offered poor footholds for webbed feet.

Once on the nest the duck promptly resumed incubation. Insinuating her body through the deep cushion of down she had originally plucked from her breast, she maneuvered her brood patch into contact with the eggs, using a series of sideways quivering motions. This done, she gradually relaxed, and after she had become accustomed to the slight sound of the camera shutter, she began to doze.

If the male does not assist in incubation he is certainly more attentive than most drakes are. Not once did a single bird approach the nest; always the pair swam up together. Nor did the off-duty bird stray very far from his mate while she





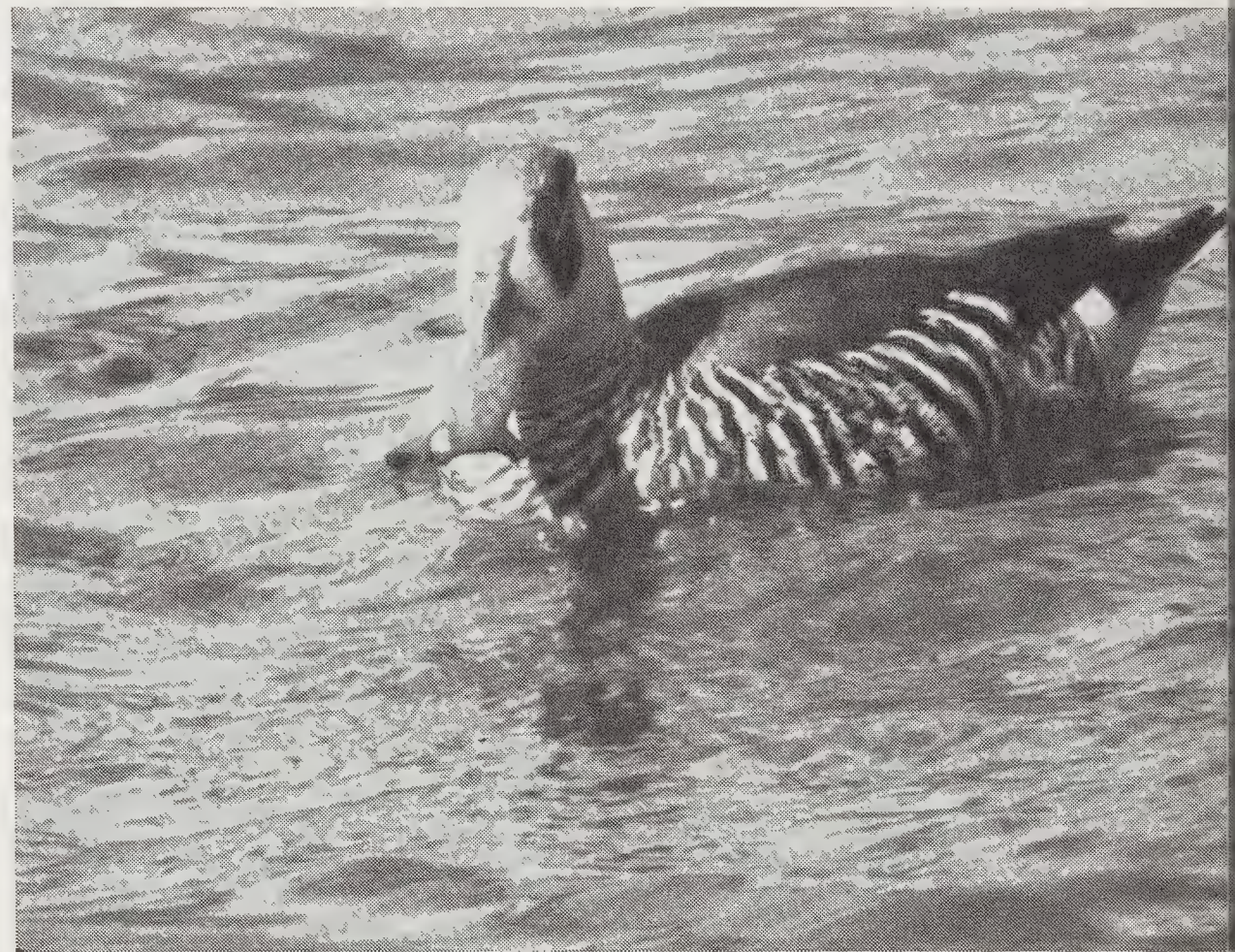
was sitting. The drake at the Paper-bark site favored a floating log about forty feet away. Here he lazed for hours, preening and scratching himself and dozing fitfully. I noticed that he was alert at any hint of danger or if another bird encroached on what he evidently regarded as his own private territory.

Looking closely at these birds I thought I could detect a difference between them: the amount of pink behind the eye seemed greater in one bird than in the other. But I found later that they sometimes fluff out their head feathers and that this has the effect of altering the size of the pink patches. They may become larger or even disappear altogether, concealed by the surrounding feathers. A bird could even have a pink spot on one side of its head and none at all showing on the other. A few minutes later both might be exposed again.

Since lowering and lifting of the crown feathers often signals emotional changes in birds, it seems probable that the pink spots function during sexual displays. As yet, however, nothing is known of the purpose of these color spots.

While incubating, the duck was silent. She

paid no attention to her mate's frequent squabbles with a pair of Coot nesting nearby. Only when a neighboring family of Pink-ears tried to pass through the sitting bird's territory did she show any interest in her mate's actions. On this occasion he steamed along the water with head and neck outstretched and threatened the invaders by opening and closing his beak. No actual combat took place but the Coot butted in and for a moment the scene was very confused. The intruding ducks hurried away, whereupon the drake suddenly lifted his beak to the sky and let off a strange trilling cry as if trumpeting his victory. At once the sitting bird, who had watched everything with the keenest attention, half rose from her eggs and echoed his cry. The drake now returned to his floating log and resumed his preening, while his mate carefully turned each egg over with the help of her spatulate bill and then



resumed her seat. She turned the eggs like this at frequent intervals throughout incubation.

Two days later when I felt beneath the soft down it was to find that hatching had begun. There were four chicks and two chipping eggs in the nest. The eldest duckling, the only one whose down was dry, promptly took off and fell into the water. Luckily I was able to grab him despite his repeated dives and, placing him in my pocket, hurriedly entered the blind.

The parent returned almost before I had sat down. At once I noted a change in her behavior. Instead of being silent when at the nest she now purred quietly as she brooded, especially when the chicks moved beneath her and made her shift

position. So far she showed no sign of taking them away; indeed she sat for several hours while I continued to nurse the eldest duckling inside the blind.

He was an attractive little fellow. The young of other ducks with spatulate bills, such as the familiar Shoveller, have plain beaks at hatching but this chick already had a flattened bill with side curtains like those of the old birds. He was energetic, too, for when I left the blind and put him in a pool at the edge of the swamp, he swam around with his bill submerged, taking the first meal of his life. He had never seen his parents feeding, but this proved no disadvantage; he sped to and fro, filtering out the water-fleas as if he had enjoyed years of practice.

Having made detailed notes of the chick's coloring, voice and behavior, I returned to the nest, slipped the young one beneath the down, where

it remained conveniently quiescent, and resumed my watch.

The duck brooded for another hour, sounding her purring calls at intervals. She seemed unusually alert and kept looking round, rising from the nest to do so. Presently she stood upright, purred strongly and dropped to the water. Her mate awaited her at the foot of the tree. The pair now swam slowly away, one bird calling loudly "tew-ee, tew-ee" and the other purring.

Obviously they were trying to persuade the chicks to leave but beneath the down piled high in the Paper-bark crotch nothing stirred. Then suddenly I spotted one duckling on the water and through a peephole saw others falling. They hit the surface like airy powder puffs, raising hardly a ripple and converged immediately towards the old birds. The scene was an animated one with the ducklings weaving curved patterns on the water as they scurried to and fro, feeding eagerly with their bills below the surface.

The duck now circled back toward the tree and appeared to be about to revisit the nest but presently she turned about and rejoined her mate. Meanwhile he formed the focal point for the ducklings' activities. Apparently unmoved by all the bustle, he simply stood on his usual log and attended to his toilet. Presently he slid into the water and bathed, scattering droplets from his flickering wings over his spirited progeny.

For another hour I was able to follow their activities and to watch the whole family gradually drift away from the vicinity of the nesting tree until it was lost to view. By now it was mid-afternoon, the sky was darkening and I had only



Upper Left — Here the down has been pulled away to reveal the eggs; normally it closes over them when the nest is vacated. Above — A pair approaching the nest. A moment later the bird on the right leaped out of the water onto the nest and settled on the eggs. Right — The male of the nesting pair on his favorite perch, a log 40 feet away.



This chick was but a few hours old and it had never seen water before. Nevertheless, as soon as it was put in the water it began cruising and filtering out food, its first meal.



just reached camp when the rain began. The Casuarinas wailed like a thousand telephone wires as the wind tore through them and the truck in which I was living rocked with the vibration of the thunder as the storm passed directly overhead. I thought of the ducklings out there on the lake, imagined them sheltering beneath some swampside bush with the rain, like a fusillade of pellets, thrashing the water around them. It was the very worst sort of weather to have to face so soon after hatching, for despite their adaptations to a watery environment, heavy rainstorms during their early days are often a major cause of deaths among newly-hatched ducklings.

I learned much from this watch. The chicks' actions once they hit the water confirmed that in the young Pink-ear feeding movements are innate, not learned. Furthermore, the change in the duck's behavior with the start of the hatch was very enlightening: her persistent use of the purring calls at the nest seemed an obvious attempt to acquaint the chicks at their most impressionable age with a note meaning "follow me." Doubtless this same note acts as a rallying call when the birds are on the water. Work at the Delta Waterfowl Research Station in Manitoba with Canvasbacks and Blue-winged Teal has established that similar notes are used by these species when leading their young from the nest or when wishing to call up stragglers during the fledging period. It was found that on the day of hatching such ducklings have a strong tendency to follow a moving object, particularly if this emits "soft monosyllabic sounds of low pitch at a rapid rate" — an exact description of Pink-ears' purrings.

Then again I found that the eldest chick also exhibited a following response. When I had placed it in the water it had swum away from me, but no sooner did I walk away myself than the duckling immediately reversed its course and hurried back toward me.

It goes without saying that there are many unsolved problems regarding the Pink-eared Duck's mode of life and behavior. For example, what is the purpose of the fleshy curtains on the bill? My own guess here is that as the birds cruise along they take in water through the tips of their beaks and eject it sideways so that the solid matter is held on the inside of the lamellae and can be removed with the tongue. Perhaps the flaps are used to control the flow of water during filtration or maybe they simply act as scrapers when the birds feed, as they often do, along decaying limbs under water.

Another problem concerning feeding habits is posed by the peculiar manner in which pairs of these ducks rotate around a point with their bills submerged. In a large flock many pairs may do this, turning couples all over the water gradually drifting along as they spin round. At first sight it seems that each pair is working on some very local concentration of food, but if so why the rotary movements? Maybe this is all really a form of display, but in the field it is impossible to see what is happening below the surface. This, and other facets of behavior will probably have to be studied in captive birds, as can readily be done in glass-sided swimming tanks. So, if the Bronx Zoo does acquire some, it will have plenty to study as well as to admire.

WISENTS AGAIN AFTER 42 YEARS

By JOSEPH A. DAVIS, JR.



ON A TREE-SHADED range in the southeast corner of the Zoological Park we are now exhibiting the first Wisents, or European Bison (*Bison bonasus*) we have had since 1917. There are two of them, a young pair born in 1957, and they arrived on August 7 as a gift from Natura Artis Magistra, the Amsterdam Zoological Garden, through Dr. E. F. Jacobi, its Director.

The ancestry of animals that come into a zoological collection is rarely important, but with

Aristo and Ardetta, our first European Bison in 42 years, were born in the Amsterdam Zoological Garden in 1957. Quiet and steady, they have immediately made themselves at home.

Wisents it matters supremely. The Wisent is dangerously close to extinction and there are probably only a few more than 200 with pure blood lines left in the world — mostly in European zoological gardens. Ours are pure, not contaminated by crossing with domestic cattle or the

American Bison, and their ancestry is attested by certificates supplied by the International Society for the Preservation of the European Bison, tracing their descent back to their great-great-great-grandparents. It could, if necessary, be traced even further back.

The two newcomers to the Zoological Park are "Aristo," son of Arsène and Artophage, born in the Amsterdam Zoological Garden on May 19, 1957, and "Ardetta," daughter of Arsène and Artemis, born in Amsterdam on June 2, 1957. Both young animals are registered in the Stud-

has been taken to insure and register pure bloodlines in the European Bison. At one time, around the middle of the last century, Wisents were reasonably plentiful in the forests of Poland, Russia and the Caucasus; the Russian herds, at least,

Below — An excellent example of a bull Wisent, formerly in the Duke of Bedford's herd. The high carriage of its head is especially notable. Right — An American Bison bull is a much "chunkier" and more heavily-furred animal. This is one of the bulls we sent to a reserve more than 50 years ago.



book of the European Bison which is kept up to date by Dr. Erna Mohr of the Hamburg Museum. If, as we hope, Aristo and Ardetta produce offspring in the next two or three years, they, too, will be entered in the Studbook and given names whose first two letters indicate that they were born in the New York Zoological Park. "Ar—" names in the Studbook denote Wisents born in the Amsterdam Zoological Garden, "Be—" names denote the Berlin Zoological Garden, and so on.

It is only in fairly recent years that such care

were strictly protected by the Czars. But the First World War rolled through their forests and the herds — always small — were virtually wiped out. The animals in the Caucasus were actually exterminated. By the Nineteen-twenties, experiments in cross-breeding had destroyed pure bloodlines in some European Bison. It was then that a register began to be kept of the known animals of pure blood.

We have every reason to believe that the first European Bison in our collection in the early



years of this century were of pure blood, although they were not "named" and no ancestry records accompanied them. Those were the days before the hybridizing experiments and there was no thought of cross-breeding.

Our first Wisents, a pair, came from the Duke of Pless who sent an ordinary postcard to the Zoological Society offering to sell two animals from his small herd in the forests of Silesia. They arrived in 1904. One lived until 1912, the other until 1917. They never bred.

The Amsterdam Zoological Garden has had excellent success in breeding Wisents and several years ago Dr. Jacobi offered us a pair when health, quarantine and other conditions were right. The two we have now received had been on exhibition in Amsterdam since their birth and are steady and well-adjusted to the noises and sights of a zoological park. As soon as the doors of their shipping crates were opened here, they bounded out, ran a few feet — and stopped to graze on the long green grass on their range.

Their new home is separated by a path from the range occupied by American Bison (*Bison bison*), a bull, cow and calf. These latter showed intense interest in the newcomers and the Bison bull ran excitedly along the separating fence for a few minutes. The Wisents paid no attention to their American relatives.

Our Wisents are, of course, still very young and it will be several years before they attain the size and weight that will make them really impressive. It is a matter of opinion as to which Bison is the more imposing. The Wisent is a forest-dwelling animal; the American Bison is primarily a plains animal. A mature Wisent stands about six feet at the shoulder, somewhat higher than the American Bison. Because he is taller in the hindquarters and carries his head higher (Wisents browse on shrubs, while Bisons are grazers), his shoulder hump is less pronounced than the Bison's. The Wisent's longer body and legs give it a rangier, less chunky appearance, than the Bison; the Wisent has scantier hair on the chest and shoulders, and lacks the thick "plus fours" that clothe the Bison's forelegs.

Wisents have been known to breed when less than three years old, although they are usually not considered mature until they are six. At this age a bull may weigh 1,800 pounds, but he does not reach his full size until he is ten. Cows are smaller.

A single calf, rarely two, is produced after a gestation period of nine months. We may have to wait a few years, but we hope that Aristo and Ardetta will be the founders of a prosperous herd of pure-bred Wisents in the New York Zoological Park.

CONSERVATION



Roger Hale

Roger Drake Hale joined the staff of the Conservation Foundation on January 1, 1955; before the end of 1957 he was asked to become a Vice-president. His acceptance and his work reflect the initiative and drive of a Yankee happily facing a continual challenge.

Business careers in textiles and principally the lumber industry, which might well have satisfied less curious and more complacent men, found Hale eager to entertain a radical shift in interest. He promptly went back to college, to study under Paul Sears in the Conservation Program at Yale University. In 1952 he was among the first group of students to receive the university's Master of Science degree in Conservation.

His interests and achievements while working for the Conservation Foundation include the organization of the first conference of its kind on graduate training in resource management and use. This was held at the University of Michigan in 1956 and resulted in the formation of the Nat-

FOUNDATION

ural Resources Study Committee, under sponsorship of the Foundation. This was followed by publication of the book, "Resource Training for Business, Industry, Government." In 1958, at the suggestion of numerous educators in this field, Mr. Hale organized the Berkeley (Calif.) Meeting of those engaged in resource training in American universities. Out of his previous experience in the timber business, Hale prepared a widely-circulated paper entitled "Pulpwood, Pesticides and People," originally given before the American Pulpwood Association in February, 1959.

At present he is, in addition to other activities, engaged on a small-woodlands study with Assistant Director of Research Wallace Bowman.

Thoreau, in "Walden Pond," makes the comment that "to be awake is to be alive." It seems to apply to Roger Hale.

Protestant Council Seeks Conservation Ethic

Because of the belief that the ethical and moral issues involved in resource use and conservation are deep within the active concern and responsibility of churches and church people, a number of meetings have been held during the summer months between Warren Ost and Dr. Cameron Hall, representing the National Council of Churches, and George Brewer and Jack Gibbs, representing the Foundation. As a result a memorandum suggesting church-wide action in resource use and conservation was sent to 80 leading figures in the political, business and cultural worlds. Replies expressing considerable interest in the project have already been received from Aldous Huxley, Sir Julian Huxley, Secretary of Agriculture Ezra Benson, Evelyn Hutchinson of Yale and many others. The project will be officially introduced on the agenda of the annual Board Meeting of the National Council of Churches early in October for immediate action.

Television

So successful was the Foundation's television series, "Survival," with Albert E. Burke, which drew more than 5,000 letters of commendation, that a new program called "Roots of Freedom" is being prepared in collaboration with the National Educational Television and Radio Center.

NETRC is now widely accepted as the "fourth television network," with 43 stations located in all sections of the United States. It is planned to kinescope the ten programs of the series in order that they may be distributed at a later date to film libraries of interested schools and colleges.

A presentation is now being made to enlist the financial support of industry in sponsoring the series.

Briefly Noted

Richard A. Cooley, our research associate with headquarters at Juneau, Alaska, has been asked

by Governor William Egan to act as advisor to a commission set up to evolve state policy regarding projected AEC nuclear testing in the Cape Thompson area . . . Dr. Osborn has accepted an invitation from the recently established Commission on Water Resource Planning of the State of New York to become a member of its advisory committee. It was arranged for Stephen Bergen to act as his deputy at the first meeting on July 31 . . . Helmut Buechner, associate professor of Wildlife Management at Washington State College, has returned from East Africa with more than 4,000 feet of color film for eventual use in a projected film on African ecology . . . Wallace D. Bowman attended the 14th Annual Meeting of the Soil Conservation Society of America at Rapid City, South Dakota. He reports that more than 2,000 people gathered to honor Hugh Bennett at the largest conference in the society's history.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

The Takin Reaches New York; Is in Quarantine Now

After many weeks of negotiations, most of them concerned with shipping arrangements by air, the Zoological Park's Takin (*Budorcas taxicolor*) — the first ever seen alive in the United States — arrived in New York from the quarantine station in Hamburg on September 30 and has been put in Federal quarantine at Clifton, N. J., for the required additional 30 days. We expect it to be released to the Zoological Park on Friday, October 30, and presumably it will go on exhibition immediately.

How the young animal, a female, was acquired for us in a remote village in Burma was reported in the March-April issue of *Animal Kingdom*. Oliver M. B. Milton and Richard D. Estes, now making a wildlife survey in Burma, had the weary task of taking care of the animal at the Rangoon airport and the Rangoon Zoo until trans-

portation was arranged via KLM to Hamburg. After 60 days in quarantine in Hamburg, the Takin was flown to New York by KLM.

Busy Days at the Aquarium

New units at the Aquarium at Coney Island, under construction all summer, were nearly completed at the end of September and in a few more days will be ready for operation.

They include a Seal unit of three large pools, an extensive picnic area and an attractive souvenir shop at the exit from the grounds.

The work was scheduled to be completed much earlier in the summer but unexpected delays were encountered, among them a strike of the drivers of concrete mixing trucks, and the Seal Pool forms could not be filled.

Penguins and Seals were exhibited during the summer in plastic pools set up on the lawn west of the main building.

Dr. Dowling Assumes Post in Reptile Department

Dr. Herndon G. Dowling became Associate Curator of Reptiles on August 1, succeeding Dr. James A. Oliver who became Director of the American Museum of Natural History on September 15.

Dr. Dowling had been Associate Professor of Zoology at the University of Arkansas since 1956. Born in Cullman, Alabama, he took undergraduate training at the University of Alabama, an M.S. degree in zoology at the University of Florida and a Ph.D. degree in zoology at the University of Michigan in 1951.



Herndon G. Dowling

He was an instructor in biology at Haverford College in 1951-1952, Assistant Professor of Zoology at the University of Arkansas from 1952 to 1956, and Assistant Professor of Zoology at the Mountain Lake Biological Station of the University of Virginia in the summer of 1954.

His research work has been particularly concerned with the classification of reptiles and at present he is working on ratsnakes under grants

from the National Science Foundation and the U. S. Public Health Service.

IN BRIEF

Walking Tjantik. On the theory that considerable exercise is natural to a Komodo Monitor in its home in the East Indies, and may even play a part in maintaining it in health, weekly walks have been arranged for Tjantik, the female Komodo Monitor in the Reptile House collection. During the extremely hot summer weather Tjantik showed some reluctance to walk out of doors into the fenced corral at the east end of the Reptile House, but after a few minutes of slow circling among the Galapagos Tortoises that share the yard, she always found that she liked the out-of-doors and was reluctant to go inside when it was judged that she had had enough sun and exercise for one day. During the cold months she will be taken on walks inside the Reptile House before the building is opened to the public.

The Staff Travels. Miss Crane of the Department of Tropical Research spent September in England, France and Holland, attending an ethological conference in England and visiting museums there and in the other countries to examine research collections of fiddler crabs . . . Dr. Nigrelli of the Aquarium attended an International Tuberculosis Congress in Istanbul in September . . . Dr. Nigrelli and Dr. Atz of the Aquarium presented papers at the meeting of the American Institute of Biological Sciences at Pennsylvania State University . . . Dr. Gandal gave papers at the Kansas City meeting of the American Veterinary Medical Association . . . Several members of the Zoological Park staff attended the convention of the American Association of Zoological Parks and Aquariums at Philadelphia at the end of September, and Miss Davall and Dr. Gandal gave papers on "Keeping Zoo Records" and "Utilization of Zoo Animals after Death," respectively.

Home-grown Birds. The Bird Department's breeding program has had excellent results this year. Birds of especial interest that have been reared include Cape Teal, Falcated Teal, White-eyed Ducks and Bahamian Pintails. A rare Su-



Giraffes are frightened so readily by the unusual and unexpected that moving one from one side of the Antelope House to the other is always a ticklish business. A transfer was made at the end of September, however, without difficulty. Offering leafy branches, Keeper Charles Foster slowly enticed one of our three Giraffes around.

matran Bronze-tailed Peacock-Pheasant chick has now attained adult size. Unfortunately, the King Penguin egg being incubated in the Penguin House during the summer was found to be infertile, after about 50 days of incubation.

Quetzal Longevity. A male Costa Rican Quetzal (*Pharomachrus mocinno costaricensis*), in the collection since October 9, 1942, died on July 20 after an accident in which it suffered a badly broken leg. It appears to have held the longevity record for the species.

Zoo Film. A documentary motion picture, in color, to show what the Bronx Zoo looks like, is being completed by Staff Photographer Dunton and will be ready for release in mid-winter.

First of Its Kind. Curious questions flow into the Mammal Department by mail and telephone and over the years the same ones recur. But recently the department was asked a question that had never come up before: Will an elephant eat

eggplant? The answer was that while we had never heard of eggplant being offered to an elephant, it eats a variety of greenstuff and presumably would relish eggplant.

PUBLICATIONS OF INTEREST

THIS IS NATURE. Selected and edited by Richard W. Westwood. 214 pages, photographs by various hands, drawings by Walter W. Ferguson. Thomas Y. Crowell Co., New York, 1959. \$5.95.

Mr. Westwood, editor of *Nature Magazine* for nearly 30 years, has selected 45 articles by more than two-score contributors and presents them as "favorite articles and stories from a famous magazine." Some are by professionals—Dr. William Beebe, Dr. Robert Cushman Murphy, Edwin Way Teale, and others of their standing as naturalist-writers—others are by amateur observers and writers. But all are informed by a love of nature, and the collection is pleasantly varied. — W. BRIDGES.

BOY'S BOOK OF TURTLES AND LIZARDS. By Percy A. Morris. Pp. vi + 229, 83 figs. (mainly photographs by the author). The Ronald Press Co., New York, 1959. \$4.50.

Mr. Morris continues his series on North American reptiles and amphibians with this new volume on some of the more common turtles and lizards. Brief introduc-

tory sections on geological history and care in captivity are followed by individual descriptions of the 94 species included. Range, identification features, and notes on natural history are given in each description, with occasional remarks on nomenclature and special care. This is a good introduction for the novice reptile enthusiast. — H. G. DOWLING

ALL ABOUT TROPICAL FISH. By Derek McNerny & Geoffrey Gerard. 480 pp., 26 text-figs., 118 black-and-white photos, 109 color photos. The Macmillan Co., New York, 1959. \$15.00.

This is a major book on home aquarium management, the best to appear in many years. It is well written and organized, handsomely illustrated and reasonably accurate in matters of scientific fact. A truly encyclopedic treatment of the hobby, with its several thousand different aquatic plants and animals, would call for a staff of experts — and a philanthropic publisher as well. Until that millenium, books such as this one are the very best we can expect. — J. W. Artz

ZOO CELEBRITIES. By William Bridges. 52 illustrations in black-and-white from photographs by Sam Dunton. 127 pp. William Morrow & Co., New York, 1959. \$2.95.

In writing of any of the "Junior" books by William Bridges, the Zoological Society's Curator of Publications, it is difficult to avoid the adjective "charming." For trite though it may be, the word applies exactly. "Zoo Celebrities," like its predecessors, has the engaging qualities of colloquialism, with no sense of writing down — or up! In makeup and presentation, there is implication that the book is intended for children, but few adults could fail to be amused and instructed by these accounts of animals and incidents in the Zoo. The photographs by Sam Dunton add immeasurably to the interest and value of this attractive little book. — LEE S. CRANDALL

EVERGLADES — THE PARK STORY. By William B. Robertson, Jr. 88 pages, 42 black-and-white and 5 colored illus. by Dade W. Thornton and National Park Service. Pub. in cooperation with Everglades Natural History Assn. by the University of Miami Press, Coral Gables 46, Florida, 1959. \$1.00.

Anyone who has gone, is going or hopes to go to the Everglades National Park is advised to get this booklet and read every word of it, for it gives the perspective essential to deep enjoyment and appreciation. Mr. Robertson, a Field Research Biologist for the National Park Service, writes in easy and non-technical style of the geologic and climatic forces that formed the Everglades, of the how-and-why of the mingling of subtropical and temperate zone plants and animals, of the mammals, birds, reptiles and amphibians and plants likely to be seen by visitors, and finally of man in the Everglades. More than most National Parks, the Everglades needs to be "explained" in order to be fully valued; Mr. Robertson will open the visitors' eyes to the truly exciting natural history of this region. — W. BRIDGES

CURIOUS NATURALISTS. By Niko Tinbergen. 280 pp., photographs and drawings. Basic Books, New York, 1959. \$5.00.

The scientific autobiography, with chapters on specific problems that have interested him, of the famous Dutch naturalist and animal behaviorist. Few can go afield with him and watch him work; reading "Curious Naturalists" is the next best thing.

THIS WORLD OF LIVING THINGS. By Paul Griswold Howes. 232 pp., drawings by the author. Duell, Sloan & Pearce, New York, 1959. \$4.50.

A confession of faith by a life-long dedicated naturalist (Paul Griswold Howes was with Dr. Beebe in British Guiana more than forty years ago), in a series of natural history essays that make thought-provoking reading.

New Members of the New York Zoological Society

(Between July 1 and August 31, 1959)

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Ernest J. Zahner

Zoo Movies

The McGraw-Hill Book Company has just sent us a check in four figures, representing royalties on sales of Society movies for the first six months of 1959. Although not enough to subsidize our total film production cost, royalties do make it possible to distribute our movies widely, an excellent state of affairs.

The films certainly deserve to be seen. Colorful, authentic and lively, the wonderful world of animals is presented in its most fascinating aspects. The use of our films in schools for auditorium and classroom showings is particularly pleasing.

The subjects now available are:

Andy's Animal Alphabet
Stars in Stripes
The Younger Generation
The World of Water
The Locomotion of Snakes
Looking for the Answers
Strangers from Afar
Elephants
Introducing the Reptiles
Biologists in the Tropics
Lions at Home
Hippos!
Adelie Penguins of the Antarctic
Antelopes of Africa
Adventure with Andy

All films are in color in 16 mm. size. Members of the Zoological Society can rent them for home showings on their own projectors at a 20% discount—just telephone the Education Department, Wellington 3-1500.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Reserve Stock

IN RECENT YEARS we have been attaching constantly greater importance to the breeding of wild animals in the Zoo. Success is meeting these efforts, as evidenced by the fact that during the last two years 46 species of mammals produced young. Birds, under our conditions, are more difficult, as they need seclusion and space, yet in this department we have been successful in rearing more than 30 species, including rarities such as the Bronze-tailed Peacock Pheasant from Sumatra. Not to be outdone, the Reptile Department has scored some triumphs of its own, among them the notable one of breeding the King Cobra for the first time in zoological history.

As a general rule animals will not breed in captivity unless they are in a condition of "welfare," mental as well as physical, and it is a reflection of the great improvement in the techniques of caring for animals in captivity that more and more success is being gained in breeding, not only in our zoo but in others here and abroad.

The desirability of encouraging the breeding of animals in the zoo is two-fold. First, baby animals have their own particular charms and certainly add immensely to the enjoyment of visitors. A second reason is that the existence of a number of species of animals in the wild state is today severely threatened. The primary goal is of course to preserve wild animals in their own natural habitat, but zoos can nevertheless do their part in helping to preserve rare forms whose situation is precarious. This is one of the reasons why we felt special joy in the recent birth of a young Okapi, one of the rarest animals on earth, that exists only in limited numbers in the tropical forests of Africa. A striking example of last-ditch preservation is that of the Père David Deer of Asia. Eighty years ago not a single example of this species remained alive in the wild. Its preservation was made possible only by the breeding herd maintained by the Duke of Bedford in England. In 1946 we acquired two pairs from his estate, the first to come to the United States. Since then eleven offspring have been reared. They are sturdy animals that ultimately might become reestablished in reserve areas.

All in all, this breeding of wild animals in the Zoo is an excellent idea. It adds greatly to the pleasure of visitors and it contributes in at least some small degree to the preservation of endangered species.

Fairfield Osborn

AN OKAPI IS BORN IN THE ZOO

By JOSEPH A. DAVIS, JR.

Assistant Curator of Mammals

IN MID-OCTOBER a male calf was born to Muyoni and Bilota, our Okapis. The birth and events of the days preceding and following it will be reported fully in *Zoologica* but that technical paper will of course omit what might be called "the human side" of the experience. Why, for example, a keeper working alone in the Antelope House must remember to hum to himself as he moves about, and how I had to learn to do the same to avoid startling an animal by appearing without warning in front of its stall. What follows here is a general account of a short period in the lives of Muyoni and her calf and the people whose whole interests centered around her at this important time.

It was late in the summer that Muyoni gave indications of pregnancy — a growing fullness of body and an almost imperceptible development of the udder. But the changes were so slight that we could only speculate about the date of birth, and all guesses set it too early. The knowledge that conception took place on August 2, 1958, was no help. There is a growing body of literature on the reproduction of the Okapi, but no agreement on the gestation period. Published es-



timates varied from 10 to 16 months, and neither extreme was convincing; by the time we were sure a calf was on the way, Muyoni had already passed the 10-month mark.

With the arrival of October we felt certain that the event was not more than a week away. All seemed quiet and normal enough, but apprehension grew as we read and reread the accounts of Okapi births in European zoological gardens. In Antwerp the first calf was aborted and the next two were killed by the mother. The fourth and fifth were removed from the mother's care immediately after birth but only one of them survived. Human intervention had been required during delivery of the first Okapi born in the Vincennes Zoo in Paris and just after the birth the mother turned on her keeper, nearly striking the baby with her hooves, and chased the man out of her stall. Her hostility did not dissipate for almost a month, although previously she had been as gentle as our Muyoni. These circumstances naturally gave us a great deal to think about.

Our only encouragement was the news that an Okapi had been born in the Brookfield Zoo in Chicago on September 17. Director Robert Bean

reported that it was uneventful — no problems at all. But Okapis obviously vary and we continued to fear and prepare for the worst.

Last-minute changes in an animal's environment may do more harm than good. For this reason we had begun in September to modify Muyoni's stall, so that she would have time to accustom herself to new conditions. The broad door leading to an adjoining stall was opened. Muyoni explored it placidly. A few days later, while she was out of doors, the barred front of the new stall was covered with sheets of composition board in which three viewing holes had been cut. Our

idea was to give her a secluded retreat when birth was imminent. The pair of Masai Giraffes quartered opposite the closed stall were temporarily disquieted by its new appearance, but Muyoni accepted it without alarm. In the weeks that followed she used the closed stall only for defecation, however.

The floors of both stalls were covered with a layer of sand, straw and fibrous litter to provide traction for the young Okapi and to cushion its inevitable falls in its first efforts to stand.

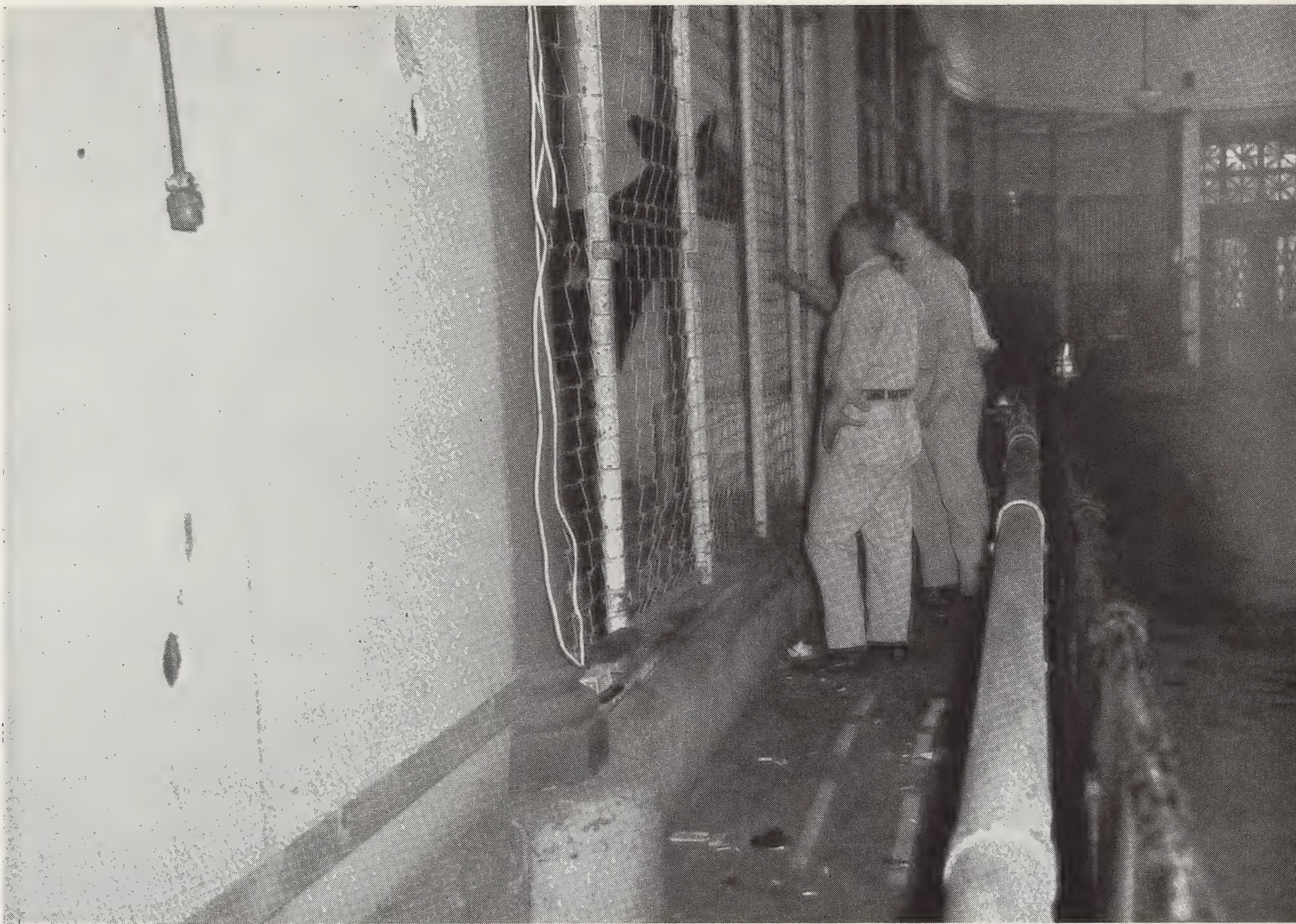
Finally, we readied towels and heat lamps, in case the baby had to be taken from its mother, and alerted the Farm-in-the-Zoo to the possibility that we would need fresh milk every day — all the while hoping that none of these things would be needed.

My own tension had built up to such a point that on October 12 I flew out to Chicago to harvest every possible detail about the last days of pregnancy and the birth and subsequent care. Mr. Bean and the keeper of Chicago's sturdy young male were most reassuring.

Slightly flopping ears seem to be a characteristic of new-born Okapis. Our baby was ten hours old when this picture was made.

From the very beginning the baby was more wary than its mother — it usually took shelter behind Muyoni or in a corner.





As I sped homeward across the darkened continent that night, Assistant Head Keeper Matty Rolla began what was to be a round-the-clock vigil outside Muyoni's stalls.

The next day, Tuesday, was another day of waiting for nature to take its course. Keeper Neil Dapolite was able to squeeze a few drops of milky fluid from Muyoni's udder, but two hours later the same procedure yielded only a clear liquid. We had hoped to get enough milk to have it analyzed, so we could make up an intelligent formula if necessary.

Tuesday night Matty again kept watch. I slept lightly at home, waiting for the phone to ring. It didn't.

The notes that follow are paraphrased from the journal the keepers and I kept in the waiting period.

Wednesday, October 14

Muyoni's udder seems fuller than before and her appetite for clover hay has increased. We think we see subtle changes in her appearance,

but these are so slight that we may well have missed them before. She seemed listless when Neil brushed her in the afternoon.

I stood watch through the night. By 6 P.M. Muyoni was her old self again. Of all the animals in the building, only the Okapis and the Gerenuk accepted my presence quietly. Only with an effort did I remember to shuffle my feet and hum as I moved around. One forgetful moment of tiptoeing and I would find the Greater Kudu poised for flight into the closed door of his stall.

I don't remember what made me think the moment was at hand, but a little after 10 o'clock I phoned Neil and he arrived at 10:30. It might have been the Okapi's heavy, labored breathing, a new development.

Thursday, October 15

False alarm. I sent Neil home some time after midnight. The Antelope House is alive with strange sounds at night, from the muted gurgle of a Giraffe bringing up its cud, through the many-toned clicks of hooves on concrete, to the

crash of a Sable Antelope jousting with his door. The faint light at the Okapi's stall is barely enough for watching Muyoni and does not penetrate to the far end of the building. Still, after a while, the sounds begin to sort themselves out and it is possible to make a kind of game of associating them with their creators. During the times that seem hours long, while the Okapi just stands quietly, monotony is an enemy and the "sounds game" is a useful employment of the mind. At 3:30 A.M. I stretched out on the cot for a moment.

At the left is the spare stall, boarded up to give Muyoni seclusion, in which the baby was actually born. Peep-holes had been cut at different levels so the progress of birth could be seen.

Measurements were obtained when the youngster was ten hours old. Here Mr. Davis holds a tape for shoulder height while Neil Dapolite soothes the baby and Matty Rolla records it all.

It was two hours later when I awoke to find someone sitting beside the Okapi stall in the half-light of early dawn. It was Matty Rolla. He, too, was beginning to feel like an expectant father, and couldn't stay away. Muyoni was lying quietly, chewing her cud.

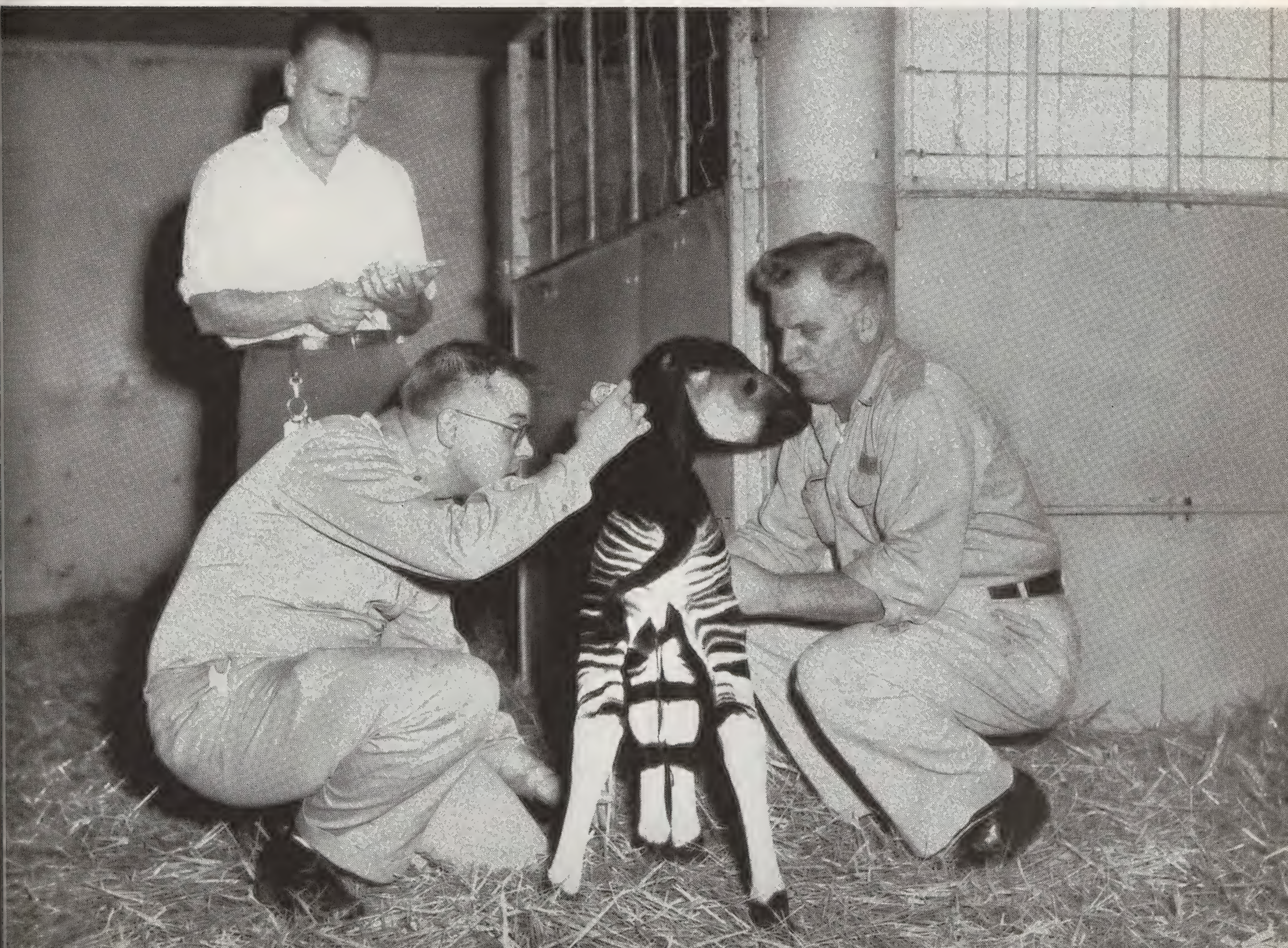
A pre-birth discharge was noticed at 7 P.M., and again at 10:30 P.M., but not enough to indicate that birth was imminent. I slept at home, planning to be at the Antelope House by 3:30 A.M.

Friday, October 16

Slept through the alarm clock and arrived at the Zoo at 6 o'clock. Muyoni was increasingly restless all day and so were we. From 8 P.M. onward she gave the appearance of being bewildered.

Saturday, October 17

At 12:30 A.M. we resolved to take turns napping. I was to sleep first, but a minute or two later Neil called me. Birth had begun and one forefoot of the baby had emerged. I telephoned for our Veterinarian, Dr. Gandal, and Matty Rolla.





Half an hour later both forelegs had emerged and then, to our dismay, Muyoni entered the closed stall and lay down in a position that hid the emerging calf from our view. At 1:45 A.M. she stood up and turned to face the rear of the stall. To my horror, the calf's legs no longer protruded. Although I knew (or thought I knew) that once begun, the process of birth does not reverse itself, it was plain that this time it had — but half a second later my flashlight disclosed a dark and almost shapeless mass in the rear of the stall. The calf, of course!

A feeble movement told us that the calf was alive. Minutes later he held his head erect. Muyoni cleaned her calf for the next half hour and, when he was 45 minutes old, the baby got to his feet. Half an hour later he took his first tentative steps and when less than three hours old he nursed successfully. Muyoni remained her usual tranquil self through this crucial period. The same could hardly be said for us.

* * *

The rest is anti-climax. None of our emergency

The calf began nursing when it was less than 3 hours old. Shown here, it is ten days old.

provisions were needed. We kept watch for the next three days, taking detailed notes, but all was normal. The calf was sturdy, strong and willful, lively enough to give his keeper a good kick. When less than 12 hours old he stood $29\frac{3}{4}$ inches at the shoulder. We estimated his weight as 35 pounds. He is much darker than his mother; almost black, with white stockings and thin tan and white stripes on the hindquarters. The sides of his face are buff, unlike the gray of both parents, but this color may change with age.

Muyoni came to us from the Belgian Congo on November 1, 1956, as a 465-pound adult. Bilota, the father, came on June 15, 1949, and was also adult. He is inclined to slash at Muyoni with his horns, so they were together only during daylight hours, when they could be watched. Thus we know the date of mating exactly and can state that in this pair of Okapis, at least, the gestation period was precisely $14\frac{1}{2}$ months, or 441 days.

THE MATAMATA

Surely *All* Turtles Can Swim . . . ?

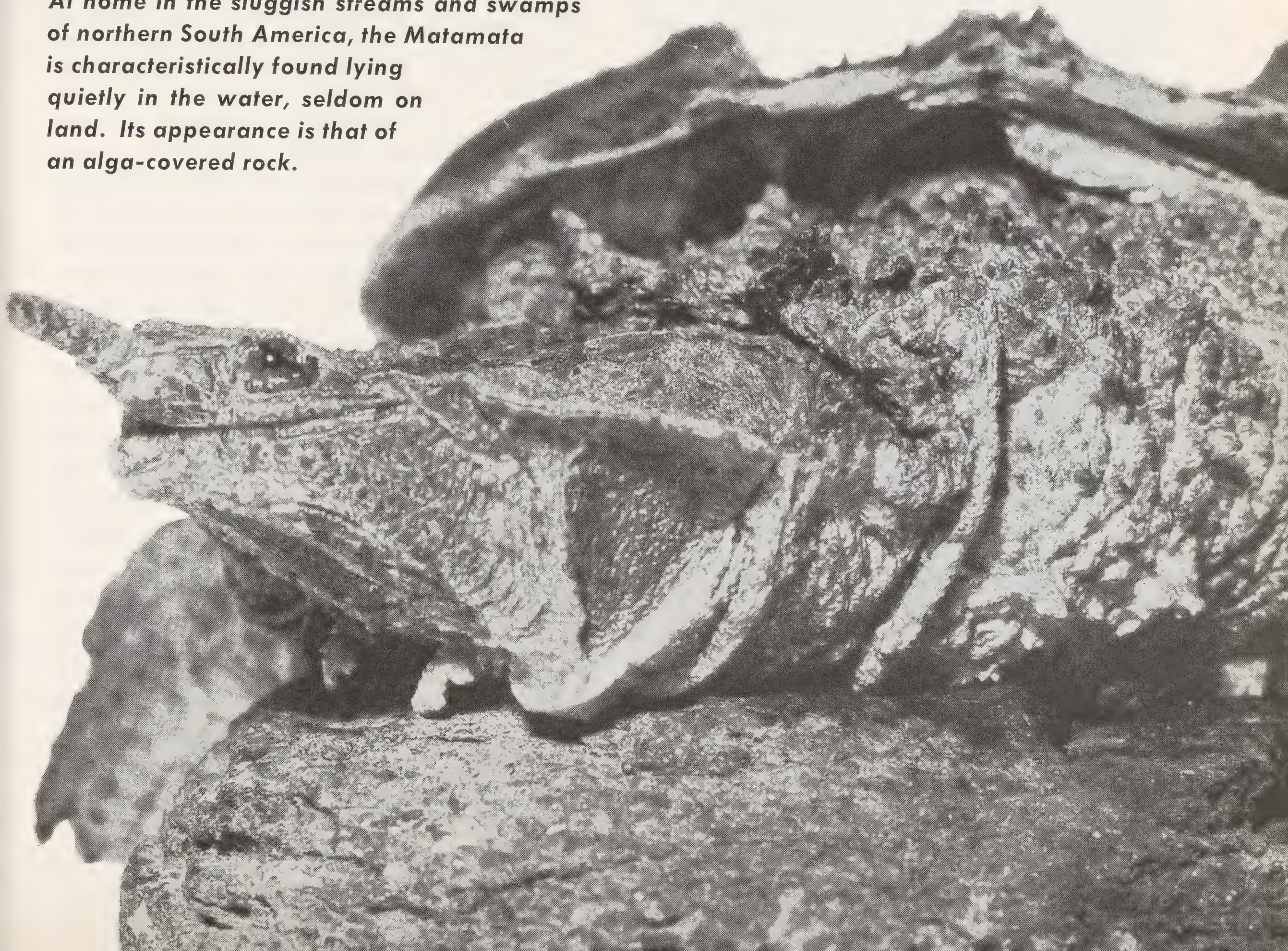
By JAMES A. OLIVER

*Director of the American Museum of Natural History;
former Curator of Reptiles at the Bronx Zoo*

At home in the sluggish streams and swamps of northern South America, the Matamata is characteristically found lying quietly in the water, seldom on land. Its appearance is that of an alga-covered rock.

THE EMINENT HERPETOLOGIST, Archie Carr of the University of Florida, once published a key for the identification of the freshwater fishes of Florida in which he dealt with one species by the simple yet forceful statement, "Any damn fool knows a catfish." Today the author of this classic phrase is one of the world's authorities on turtles, and he would doubtless subscribe to the use of a similarly emphatic statement about the swimming abilities of turtles. Everyone knows that turtles can swim — *all* turtles, not just those that live in water. Some of the land-dwelling forms may do so with little grace or efficiency, but they do swim.

The Reptile Department of the Zoological Park has always accepted this generalization without question. That is, it always did until this past summer when its faith in the all-inclusiveness of the statement was shaken for a brief period. It all started when Head Keeper of Reptiles Stephen





Spencook put a small Matamata (*Chelus fimbriatus*) in the Sideneck Turtle tank in the Reptile House. The turtle had been living in the "Turtle Pond" in the building for five months and was apparently in good health. The water in the Sideneck's tank is about 20 inches deep in all sections but has a rock shelf on which turtles can climb with ease. The "Turtle Pond" has a sloping bottom and consequently shallow water on at least two sides.

The Matamata was placed in the Sideneck's tank in the afternoon and was found dead the next morning without any obvious cause of death. A short time later we obtained another small Matamata and placed it in the same tank. This time the turtle was put in its new enclosure in the morning and a little more than an hour later it was noted floating belly-side up about four inches off the bottom of the tank. Mr. Spencook removed it and found it limp and seemingly lifeless. He laid it on a table and manipulated the four limbs to determine whether it was dead or not. The turtle revived and was replaced in the "Turtle Pond" where it got into no further difficulties.

As a result of these experiences and subsequent observations on this turtle, Mr. Spencook came up with a bold opinion that the Matamata could

not swim and would drown if placed in deep water. Such a preposterous statement could not go unchallenged. Surely everyone knew that *all* turtles could swim. But Mr. Spencook has long held my respect as the best Head Keeper of Reptiles in the business and I could not ignore his opinion as that of an uncritical or excitable tyro. Still, that a turtle might not be able to swim was too much to believe without proof.

To test the matter, Mr. Spencook, my daughter Patricia Oliver, and I soon ran some simple experiments on the Matamata. We placed it in the center of several different-sized pools where there was deep water. Each time the turtle was put in the water it sank straight to the bottom without any movement of the legs, making no effort to swim. After remaining motionless for 15 to 35 minutes, the turtle would slowly stretch out its long neck and point its schnorkel-like nose toward the surface. Sometimes the turtle would rise vertically and stretch upward so far that it was standing only on one claw of one foot. But never did it try to swim to the surface nor did it ever lose contact with the bottom. Failing to reach the surface in this fashion, the turtle would settle back on the bottom and walk along, occasionally stopping to stretch upward. Finally when it had moved into sufficiently shallow water to reach the



Various stages of the Matamata's attempts to reach the surface to breathe are shown here. An exploration of its tank, seeking a shallow place, is first. Then comes a stretching upward toward the surface, a maneuver many times repeated. In one tank it was able to reach the air by standing on one hind foot.

surface, it would breathe. If there was any object on the bottom, including another turtle or even an alligator, the Matamata would climb on this and stretch toward the surface.

We repeated these observations a number of times in various pools with differing depths of water. At no time could we induce the turtle to swim. Could it be true that the Matamata couldn't swim? Or was it so lazy that it simply didn't want to make the effort? Perhaps our turtle was just an individualist and it wasn't representative of the species at all.

The Matamata is an inhabitant of sluggish streams and swamps of northern South America, from the Andes east to the Guianas and southward throughout the Amazon Valley. It rarely comes out on land and characteristically is found lying quietly in the water. When it moves, it does so slowly by walking along the bottom. The over-all appearance of the turtle is that of a non-



descript, flattened, alga-covered rock. Closer inspection reveals a jagged, oval shell, four small webbed and clawed feet, a short tail, an enormous long, thick neck and large head. The skin over most of the head, neck and body is covered with rugosities and fleshy projections. Could it be that this bizarre turtle had become so completely adapted to living quietly like a camouflaged rock on the bottom of shallow bodies of water that it was unable to swim? This called for further investigation.

I soon obtained four more of these interesting turtles and we determined to settle the matter once and for all. We placed the two smaller turtles in separate aquaria and gradually increased the depth of water until it was impossible for them to stretch up to the surface. The two larger turtles were placed in a large tank with a depth of water of two feet. This tank had several large, rounded boulders on the bottom, but the turtles could not reach the surface vertically from the largest of these.

The behavior of the turtles in the latter tank was most interesting. When first placed in the water, the larger one sank to the bottom and remained motionless for more than half an hour. Then it crawled slowly around the tank, climbing up on each large stone and stretching toward the surface. This was continued for two hours and 35 minutes without a breath. At this time it laboriously and awkwardly but vigorously climbed up the side of the tank, seeming to dig its claws into minute irregularities on the partially painted masonite wall. At last it reached the surface and took a breath. However, neither observer believed its movements could be described as swimming. An hour and five minutes later this same turtle repeated the performance.

It still looked, incredibly, as though the Matamata could not or would not swim. The small legs seemed unable to give sufficient propulsion to the heavy shell and body. In the meantime my daughter had been watching the two smaller turtles in the glass aquaria. One of these with a dorsal shell length of five and a half inches could still reach the surface to breathe at a depth of 11½ inches by standing vertically on one hind foot. The other, a slightly smaller individual with a dorsal shell length of five inches, could reach to only about 11 inches. At a greater depth it

would vigorously push or jump vertically and reach the surface. Then after being under water 56 minutes and 30 seconds this little turtle laboriously *swam* to the surface from the vertical stretching position. *This* Matamata could and did swim!

The smaller of the two turtles placed in the large tank at a depth of two feet exhibited the same ability. It could swim in a vertical position, but only with considerable effort and *only* after trying to reach the surface by stretching. Later we increased the depth in this tank to three feet and the turtles still could swim to the surface to breathe. We never were able to induce them to swim horizontally. They swam vertically only when they appeared to be under great stress and could reach the surface by no other means. However, all four individuals did swim when their need for air was great enough.

One series of observations reported recently in the literature is of interest in this connection. When Charles A. Reed was in the mountains of northern Iraq doing archeological work he noted that the Caspian Turtles (*Clemmys caspica caspica*) inhabiting a spring and short stream in the area did not swim. When they came to the surface to breathe, they did so by climbing up the muddy bank to the surface. Reed put one in a bathtub and gradually raised the level of the water until the turtle could no longer reach the surface even by standing vertically against the side of the tub. After twenty minutes the turtle was "acting in a manner I would describe as frantic," but at no time did it swim or endeavor to do so.

It is possible that the turtle in the tub was not put under sufficient stress to make it swim. In the light of our experience with the Matamata, I believe this must be the case. Certainly Caspian Turtles from other areas swim and do so quite well, as Reed noted and as we have verified with specimens in the Zoo. It is interesting, however, that the turtles in Iraq did not swim customarily. How widespread this behavior may be in turtles is not known. Certainly there are other species that characteristically walk along the bottom rather than swim. But as far as we now know, there are no exceptions to the generalization that all turtles *can* swim — say it however emphatically you will.

TRUMPETER SWANS RETURN TO THE ZOO

By WILLIAM G. CONWAY

Curator of Birds

SIXTY YEARS AGO Dr. William Beebe prepared an 8- x 10-inch sheet of paper with the heading "Catalogue, *Olor buccinator*, Trumpeter Swan," and entered under "Arrivals," "Three specimens, Idaho — July 15, 1899." It is thus a matter of record that the Trumpeter Swan was among the first specimens acquired by the New York Zoological Park, even before its formal opening in November, 1899. Thereafter the species maintained residence in the Park almost continuously until September 15, 1928. With this last entry, the death date of our last specimen, there was an air of finality, for in 1928 it seemed unlikely that the gradually-yellowing Trumpeter Swan record sheet would ever be taken out of the files for another entry. The Trumpeter was known to have once bred throughout an immense area from southern Alaska to California, east to Manitoba, Minnesota, Indiana, Iowa, Nebraska and Missouri, and to have wintered south through the Mississippi Valley, Illinois, Louisiana and Texas. But as early as 1910 it was thought to be extinct in the United States, although it was still found in Canada and Alaska. Eventually a very few pairs were located in Yellowstone National Park, but the future of the bird appeared bleak indeed.

Trumpeters had disappeared for a variety of reasons. Much of their original nesting territory had been appropriated for settlement by man. They were not so wary as the Whistling Swan and were easily killed by gunners. Their great size made them tempting and easy targets. Size

gave them an obvious value as food, and it is even said that numbers were killed just for their skins, which were used to manufacture powder-puffs.

In view of all this, it is wonderful to be able to report that the Trumpeter Swan catalog card, after a rest of nearly thirty-one years, is active again. It has a new entry: "Two Trumpeter Swans, July 18, 1959, deposited by the Fish and Wildlife Service — collected near Monida, Montana."

By 1935, about sixty Trumpeters were known to survive in the United States in Montana's Red Rock Lakes and Wyoming's Yellowstone Park. In that year the Fish and Wildlife Service established the Red Rock Lakes Migratory Waterfowl Refuge and in the excellent sanctuary thus provided the birds have made a marvelous comeback. The Service has maintained a careful watch over the swans and taken a census of the population regularly. By 1949, the United States' population had increased to 451, and Daniel Janzen, Director of the Fish and Wildlife Service, notes that the 1958 census revealed 697 birds. The Canadian and Alaskan population numbers about 900, so that there are now approximately 1,600 Trumpeter Swans in North America. Survival of the Trumpeter in the United States seems assured for many years to come because of these timely conservation efforts.

In addition to providing sanctuary at Red Rock Lakes, the Fish and Wildlife Service has drawn upon the successful Montana population in attempts to establish other wild populations. "Seed-

ing" has been tried in Oregon, Nevada and Wyoming, but as yet only the Wyoming introductions have met much success. Jean Delacour worked with the Service from 1944 to 1947 on this program and reports in his book, "The Waterfowl of the World," that inadequate captive breeding facilities and the difficulty of obtaining experienced and permanent swan keepers led to the failure in Oregon and Nevada. However, the Service has indicated that the seeding program will continue and we may probably look forward to even further increases in Trumpeter numbers.

Several years ago Mr. Delacour noted that "the protected population of Trumpeters in the sanctuaries of Montana and Wyoming has reached saturation point," and in a recent letter Mr. Janzen comments, "An analysis of the recent population trend has shown that our objective of maintaining the wild population (in the refuge areas) at the maximum sustained level which the limited environment is capable of supporting has been achieved."

Careful protection has thus made it possible, once again, for millions of Zoo visitors who cannot see the wild population to view the largest of the world's waterfowl and heaviest of North American birds. Not only is the Trumpeter the largest of the world's swans, but it is among contenders for the title of "the largest flying bird," for Trumpeters may weigh more than thirty pounds, have an over-all length of more than 65 inches and a wingspread exceeding eight feet. The Trumpeter takes its name, of course, from its wonderful voice, among the most powerful and perhaps the most striking of all North American animal noises. Gabrielson and Lincoln, in their recent book, "Birds of Alaska," characterize it best: ". . . great sonorous but musical trumpeting, placing it as the most striking bird voice on the continent." To this we must add a fear-inspiring hiss, noted when we have handled or examined our two birds.

Of course, we hope we may some day breed our Trumpeters, for they have bred readily in captivity in the past. Young were raised as early as 1870 in the London Zoo and as early as 1885 in Paris. The most successful breeder of Trumpeters was Mr. F. Blaauw, in Holland, who raised many birds over a period of more than thirty years. On

Mr. Blaauw's death, according to Mr. Delacour, the birds were bequeathed to the Duke of Bedford in England, where they all died between 1939 and 1945 through lack of food during the war. Our last Trumpeters were received from Blaauw in 1921. After the loss of the Blaauw stock in England, there were no Trumpeters in Europe until 1952, when the Canadian Government presented several birds to the Severn Wildfowl Trust. Two female cygnets were added to the group in 1956, and Peter Scott reported in September of this year that one of these young birds was incubating eggs. Within the next few years the birds may again be established in European collections.

In 1938, C. L. Sibley bred a hybrid between a cob Whooper Swan and a pen Trumpeter. Hybrids with Whistling and Mute Swans have also been reported, and at least one hybridization with a Canada Goose is on record. The Fish and Wildlife Service has cautioned Zoo recipients of Trumpeter Swans to take care to avoid hybridization.

Strangely enough, until this year no captive Trumpeters had bred in North America. Then, in June, five cygnets were hatched at the Delta Waterfowl Research Station, Delta, Manitoba. Four of the cygnets were taken from the parents and hand-reared, and the fifth, which hatched two days after its siblings, is being reared by the parent birds. An important consideration in successful waterfowl breeding is the background of the female parent. Aviculturists have repeatedly noted that wild-caught adult female ducks, geese and swans are usually very reluctant to breed in captivity. Females reared from eggs laid by wild pairs or taken while very young usually breed readily, as do captive-bred females. Wild-caught adult males usually show no such parental restraint. In this connection it is interesting to note that the Delta female parent Trumpeter was received as a cygnet, only a few weeks old, for hand-rearing, though the male is a wild-caught adult. Unfortunately, the male Trumpeter is the younger of our pair, still showing the pale feet and a few brown feathers of an immature bird's plumage, while the female appears fully adult. Barring accidents, we look forward to a long residence with our Trumpeters, for swans are long-lived, and there is one captive record of 32½ years for a Trumpeter.



When the Takin stepped out of her shipping crate in the Bronx Zoo, two friends who had known her in Burma were on hand to welcome her to New York — Mrs. Ann M. Milton and her son, Eric.

A RARITY FROM BURMA—

The First Takin In America

By ANN M. MILTON

EDITOR'S NOTE. The young female Takin (*Budorcas taxicolor*) whose acquisition by the New York Zoological Society was recorded in the March-April issue of *Animal Kingdom*, was released from Federal quarantine on October 30 and went on exhibition in a corral at the Antelope House the same day. She is the first Takin to be exhibited in the United States.

All accounts of the animal we received from Burma and the quarantine station in Hamburg (where she underwent 60 days' detention before

being flown to New York) had stressed her liking for being with people. There was no doubt about it when the bamboo shipping crate was opened and she walked out into the corral. With complete unconcern she strolled through a group of photographers, explored her new home and then stood quietly for pictures with Mrs. Ann Milton, whose husband, Oliver M. B. Milton, obtained her for us in Burma. Four-year-old Eric Milton, who had often played with her in Burma earlier this year, petted her and fed her wisps of clover



The Bronx Zoo's Takin was captured just beyond this mountain range in North Burma. The highest peak rises 14,300 ft., and the whole range is used by local tribes for hunting Takin and Serow.

Oliver M. B. Milton Photo

hay. When she had had enough posing, she simply strolled away, explored some more and then stood for more pictures. Visitors outside the fence seemed to attract her, and several times she stood on her hind legs with forefeet braced against the fence, as if to climb. Her talent for climbing—or jumping—is giving us some concern, for the fence around the corral is only 7½ feet high, and the winter shelter being designed for her will have to be far enough away from the fence to prevent a leap out.

Coming as she does from the high mountains of the border between Burma and China, New York's winter weather should be extremely comfortable for the Takin. We expect to give her only a simple shelter against sleet and freezing rain.

Food has proved to be no problem. Leaves and grass are presumably the animal's chief foods in the wild, and in the Zoological Park she is eating a ground-grain mix, oats, sweet potatoes, Irish potatoes, carrots, cabbage and clover hay. She weighed 155 pounds on arrival. Male Takins are said to reach a weight of 600 to 700 pounds, but females are smaller. At the end of October our Takin was about 20 months old.

WHEN I FIRST SAW the Takin she was roaming freely through the underbrush and bamboo fencing of the small Rawang village of Sangawng, eight miles west of Putao, Burma's northernmost town.

She had been caught by hunters from this village in an area about ten days' walk northwest, on the borders of the Mishmi Hills. Being no more than two months old at the time, she was carried on their shoulders back to Sangawng.

Here the houses are built of interwoven lengths of split bamboo. With heavily thatched roofs, they stand on posts usually five or six feet off the ground. Domestic animals find shelter underneath, in the storage area for firewood, baskets, extra thatch and a rice-pounder. The people live simply, by fishing, hunting, cultivating and weaving.

The Burma Wildlife Survey team of my husband, Oliver Milton, and Richard Estes, walking up from Putao, arrived at the village one afternoon in February of this year for a dual purpose. One was to arrange for a two months' survey in the snow mountains that separate Burma and Assam and the other was to dispatch this small Takin to her new owner, the Bronx Zoo.



Eric, our young son of three, and I were greeted by the men and a group of Rawangs some hours later. Our pace had been slowed by three ox carts laden with kit and Eric as sole passenger.

That same evening I saw the young Takin grazing outside a stake fence on the main village path. It was just possible to make out her dark brown coloring accentuating a broad, dun, saddle patch. Large eyes were set in a neat head and her black face ended in a soft but Roman nose. A certain sign of a definite will of her own, I thought. Small, pointed horns had protruded an inch or so. The widely separated hoofs reminded me of Chinese women I had seen with bound feet. The Takin's were so small and high for the thickness of her legs that they gave her the appearance of walking on minute high heels. Her back, with pronounced goose rump, gave a sudden slope to the tail from the withers, which only measured twenty-seven inches off the ground. The legs were heavy-set and well covered. It seemed to me that she looked much like a goat from the front and a bear from the rear.

Takins range through rhododendron forests on the lower slopes of the mountains. Here, at 8,000 ft., the Burma Wildlife Survey encountered numerous Takin tracks and droppings.

Oliver M. B. Milton Photo





In the morning Eric and I went off to find the little animal, which we saw grazing with one of the cows in a field at the end of the village. A small boy drove her up to us and there she stood quietly for a few moments. With her head held in a horizontal position, she paid no attention to the fact that three small Rawang boys and Eric were leaning on her back. I patted the luxurious growth of her rather long, soft, hair and ran my hands along the thick and muscular neck to her large ears and strong cheek bones covered with hair that was almost black. Seemingly bored with attention, she moved off a few paces with long, sure, strides and started to graze on the young leafy vegetation she enjoyed. I smelled my hands, aware of her definite but not unpleasant musky odor.

She treated the children of the village with a measure of acceptance, but when they annoyed her too much she would walk along in front of them and then suddenly, with almost unbelievable speed and dexterity, dart through a narrow opening in the bamboo fencing surrounding one of the houses.

When we first arrived in Sangawng I noticed that the early hours of her days were spent grazing with some cows, calves and goats. Eventually they would all lie in the coolness of the soft dirt

Above — Eric Milton (foreground) and children of the village made a pet of the Takin. Below — Finishing a meal of rice gruel at the airstrip at Putao. Food generally kept the animal quiet.

R. D. Estes Photo





Above — Bedded down for the night on the porch of a Sangawng house. Right — Director U Kyaw Thein of the Rangoon Zoo took a great liking for the Takin while it was in the Zoo.

R. D. Estes Photo

under the houses. At night the Takin would sleep on the “porch” of one house, where she would lie like an enormous dog, seemingly oblivious of any disturbances. As time went on it became quite clear that she thoroughly enjoyed human companionship.

Her firm attachment for the cows, and to one in particular, gradually dwindled and she was seen more often on her own or grazing further away from them. The goats, who were always being chased by the local dogs, treated her with more aggressiveness, but because of her bulk and strength they always backed down in any real argument between them. It was most amusing to see the Takin with her tiny horns trying to butt the goats and then to watch them all scramble up the bamboo ramp and onto the low “porch” of one of the houses. Here they all stood to gain a better view and sparring advantage over the goats still left on the ground.



The Takin had a will of iron combined with strength and agility that amazed us all. Once she made up her mind to do something, or go somewhere, there was little that could change it. The village dogs would occasionally bark mischievously at her, but they soon gave up; instead of running like the goats under similar circumstances, she would lie or graze where she was, paying not the slightest attention to them.

Many unsuccessful attempts were made to get her airlifted out of Burma for a quarantine period in Hamburg before the monsoons and the very hot weather arrived. Finally it was thought best to keep her in Sangawng, if no other flights could be arranged, until our return from the North. At that time a concentrated attempt could be made so she would not have to stay in the terrific heat of Rangoon while awaiting a connecting plane.

During the first week of April we returned to Sangawng. Eric was carried in a basket and we walked for two long days over what seemed at times a nearly impassable trail. The penetrating wetness of February had perceptibly changed to the hot, sticky, oppressive, pre-monsoon weather. The Takin now grazed in the early mornings and evenings, spending the rest of the day panting under one of the houses. We were all concerned for her health should she have to spend any time at all in Rangoon.

But this proved to be unavoidable, for when she finally arrived in Rangoon at the end of April, there was no plane service available to fly her to Germany. Every possibility, for one reason or another, fell through at the last minute. Very kindly and fortunately the Manager of the Rangoon Airport told Oliver that the animal could remain in a small air-conditioned room at the airport for an acclimatization period. A barricade was arranged to close the front opening, there being no door, and the Takin's crate, once placed in the room, was opened after the crowds had dwindled. She peered out, was given some food, which she ate, and then walked into her new accommodation with no bother at all. I heard later from Dick, who had waited up North to make certain she left Putao, that she had entered her crate on the airstrip and made the trip down with the same amazing docility. Measured again, she was found to have grown five inches in just over three

months. Her weight was one hundred and fifty pounds. A man from the Rangoon Zoo was on hand the entire time and the Zoo Director also kindly supplied Oliver with her food, thirty-five pounds of green leaves each day. In the cool of the evening, when the temperature might drop to the high eighties, Oliver or the keeper would take her out for a stroll, giving her some relief from the caged area.

In such close proximity to so many human beings, the Takin became increasingly fond of their company, so much so that the keeper found he could barely leave her for a minute. On one unfortunate occasion, when no one was present, the Takin became anxious and in leaping against the steel-expanded barricade, caught one of her three-inch horns in the fence and loosened it. A few days later the horn came off. There was great speculation as to whether it would grow again. Most people thought not, but apparently it has made a certain amount of new growth in the months since then and may some day be almost as large as the undamaged horn.

After three weeks of imposing on the airport's hospitality and much needed space, Oliver moved the Takin one evening by truck to the Rangoon Zoo. The air was a bit cooler now — for Rangoon — and the Director had designated a shady corner for her comfort. Here, too, she was given the greatest care and attention until an airlift was arranged some weeks later.

During her stay at the Zoo she became internationally known and endeared herself to a great many visitors. Judging by photographs I have seen, Director U Kyaw Thein also grew very fond of her. No one knew for certain how long the Takin could endure the heat of Rangoon as a sudden change from her mountain home, but with only slight loss of weight she remained in good condition for her entire stay at the Rangoon Zoo, thanks to the excellent care she received there.

A combination of unlimited efforts on the part of Oliver and Dick proved unshakeable and finally as a reward for their patience and perseverance KLM Royal Dutch Airlines was persuaded to remove fifteen seats from one of its passenger planes and on July 26 the Takin was airlifted to Germany, the first leg of a long trip to the USA, the Bronx Zoo and her new home.

The Great Tinamou of the Tropical Forest

By ALEXANDER F. SKUTCH

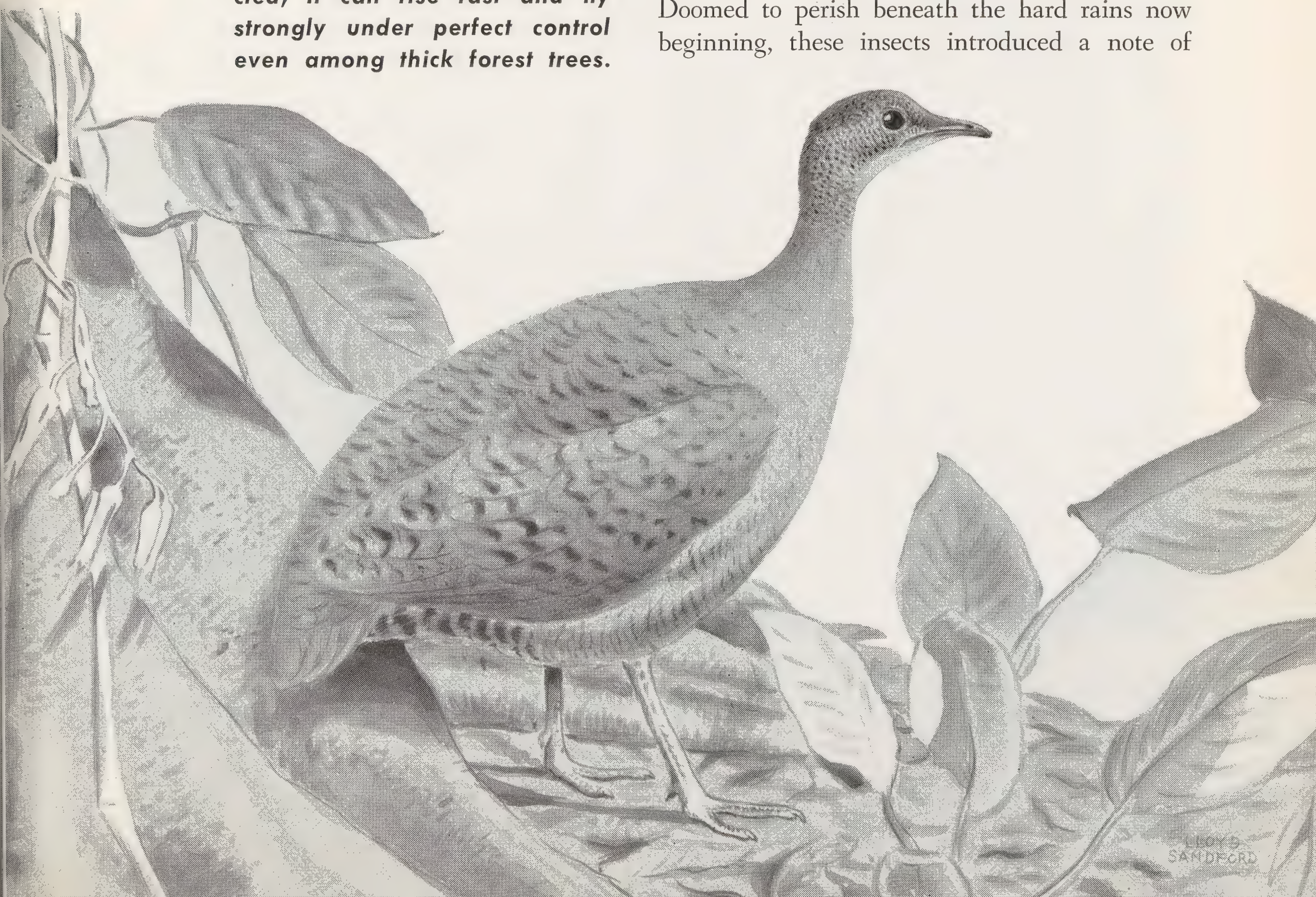
San Isidro del General, Costa Rica

I STOOD ON A WOODED RIDGE, amid palm trees whose slender, soaring trunks thrust feathery crowns into the high canopy of the rain-forest. Around me grew clusters of low, spiny palms, with ribbed fronds that tapered to tips beneath which brown hermit hummingbirds fastened their downy nests. My eyes followed the graceful curve of a woody vine upward to the lofty bough from which it hung, like a tree trunk that had lost its power to stand erect. The forest dripped after the heavy afternoon shower of early May; but the sun, sinking low above the wooded

The Great Tinamou is about the size of a Guinea Fowl but unobtrusively marked. Heavily muscled, it can rise fast and fly strongly under perfect control even among thick forest trees.

summit of the opposite ridge, sent nearly horizontal rays through a gap in the massed clouds.

Far above me in the sunlit tree tops, a party of toucans were singing their vespers, throwing their great yellow and chestnut bills skyward as they began each high-pitched verse. A Black-faced Ant-thrush, walking daintily over the leaf-strewn ground, whistled thrice in a full, mellow voice. From the ferny undergrowth came a Brown Manakin's exquisite whistle, ascending in three stages. A sweet, slight call revealed the presence of a Black-striped Woodcreeper, clinging unseen to some high trunk. The cicadas, which through the dry early months of the year had filled the woodland with their strident sounds, mingled their sharp sizzles with the liquid notes of the birds. Doomed to perish beneath the hard rains now beginning, these insects introduced a note of



mutability and death into the joyous woodland chorus.

Suddenly a strong, solemn voice swelled through the forest, overpowering all its slighter sounds as the sunshine dims a lamp. Now on one side, now on another, the organ peals were repeated, saturating all the woodland with pure sound. In a song consisting of two full, long-drawn notes several times repeated, the Great Tinamous (*Tinamus major*) were heralding the approach of night.

For a few minutes the tinamous' whistles pealed intermittently through the forest, then they fell silent for the night. As I walked homeward along a narrow, fern-bordered path, the last of the pyrophorus fireflies, creatures of the dry season, traced brilliant, erratic courses through the trunks of the great trees — my trees. Recently I had bought this forest, along with the adjoining clearings and small plantings of a farm newly carved from the wilderness in southern Costa Rica, and close beside it I had built a house which I hoped would be my home for many years.

Sometimes as I followed a forest path I met a Great Tinamou, a bird the size of a Guinea Fowl, with a stout, faintly barred, olive-brown body, a slender grayish neck, a small chestnut head with large, dark eyes, a straight bill of moderate length, and a negligible tail. After walking ahead of me for a short distance, the tinamou would quietly vanish into the surrounding undergrowth. These birds were almost always alone, although once I met a parent who led three half-grown chicks for a good way down a forest road before they veered aside into the underwood.

More often, especially while walking through pathless woodland, I would become aware of a tinamou, not by sight, but by a startlingly loud burst of wingbeats as the heavy bird rose from amid screening herbage and flew rapidly away between the tree trunks, to alight at some point beyond my vision.

Although the abrupt rising of the heavy tinamou seems to demand an effort too violent to be under perfect control, I have never known the bird to strike against an obstacle, as, according to W. H. Hudson, the Spotted Tinamou of the open pampas of South America frequently does, with fatal results. Any tendency by a forest-

dwelling bird to collide with the trees that closely surround it would be sternly suppressed by natural selection. In Panamá, Frank M. Chapman saw a Great Tinamou fly up in this way when stalked by a Tayra.

One does not often see a bird as large and shy as the tinamou at ease in its natural setting, but years ago in the forests of Panamá I enjoyed this unique experience. I was spending the morning in my little wigwam of brown cloth, watching a Yellow-thighed Manakin attend her eggs, when I noticed the tinamou about thirty feet off. For a long while it walked around in small circles, from time to time picking up something edible, but never quitting one small area. I wondered what the attraction of this particular spot of the forest floor could be, but I did not wish to emerge from hiding to investigate.

Presently a Brown Dendrocincla, next a pair of Spotted Antbirds, arrived to accompany the tinamou, and from tree trunks or saplings dropped to snatch something from the ground, then rose at once to their low observation posts. This behavior, typical of followers of army ants, assured me of their presence, long before they came close enough to be distinguished. The tinamou was picking up the insects and other little creatures driven forth from the ground litter by the hunting ants.

I had known the tinamou for years before I ever saw it elsewhere than on the ground or on the short, low flights it makes when disturbed. As I passed through my forest one afternoon in September, a tinamou rose from the undergrowth to a stout horizontal limb of a tall tree, forty or fifty feet up. Here it stood for so long that I thought it had gone to roost, although another hour of daylight remained; but when I returned ten minutes later, it had vanished.

The following April I stood quietly in the forest as the day waned, watching a low, globular nest in which I hoped to see an elusive Nightingale-Wren retire for the night. As the light faded, a tinamou flew into a neighboring small tree, to alight on a nearly horizontal bough a few inches thick and about twenty feet up. This was at the enchanted period of the twilight when the tinamous were raising their voices here and there in the distance; but the bird in the tree stood silent and motionless.



In such forest as this — which happens to be in the rain-forest of Honduras, in the Great Tinamou's range — the bird is perfectly at home. This shows the base of a huge silk-cotton.

When the Chestnut-mandibled Toucans had finished their vesper chorus and it was nearly dark in the underwood, I advanced cautiously toward the tinamou's tree. Since the bird gave no evidence of alarm, I grew bolder and went closer. Throwing the beam of my electric torch on it, I moved all around and beneath it, keeping it always in the circle of light; but its only movement was to turn its head. The reflection from its eyes was white, not ruby like that of the Pauraque of the neighboring clearings. To judge by the brilliance of its eye-shine, the tinamou sees fairly well at night. I wished to learn how it grasped its perch, but my light was not strong enough to reveal this detail. Finally I departed, leaving the tinamou resting peacefully in the very spot where it first alighted.

Formerly, when I was wakeful at night and heard a tinamou calling in the neighboring forest, I was troubled by the thought that it wandered over the ground, exposed to all the perils of the tropical forest. But now I pictured it resting on a high bough in relative security. The Great Tinamou does not join the dawn chorus, and it sings only sporadically through the day, as it does in the night. Its principal period of song is in the evening twilight.

ONE DAY IN JUNE, as I walked through the open woodland near the rivulet at the western boundary of my farm, three big, intensely blue eggs caught my eye from a distance. Save the morpho butterfly's satiny wings, these were the most vivid objects in the forest. They lay near the top of the low bank on the farther side of the stream, at the base of a clump of tree ferns. Although somewhat screened by the heart-shaped leaves of a terrestrial aroid, they were so inadequately concealed that I could see them from a point a hundred feet away.

Refraining from approaching for a closer inspection of these lovely eggs, I marked with a stick the most distant spot from which they were visible. Next day I cautiously returned to my marker, hoping for a glimpse of the parent bird, whatever its kind, as it covered the eggs. But alas! they had vanished, leaving only a few fragments of glossy blue shell scattered around the spot where they had rested on the ground, with no sign of a nest. From descriptions that I had read,

I believed them to be eggs of the Great Tinamou, but these were the first that I had myself found.

A decade passed before I found my second tinamou's nest, a shallow depression in the ground litter at the base of a small tree near the forest's edge. The two eggs were unattended and cold, but not far off I saw a Great Tinamou. Two days later there were still only two eggs, cold and wet; but on the third day I found three eggs, still cold. On the fourth day I at last found a tinamou covering the eggs — my first unexceptionable proof of the identity of these lovely objects. While I stood watching the bird from a distance of about twenty feet, it suddenly flew up — directly from the nest, it seemed — and with a great burst of wingbeats shot out of the forest and over the adjoining second-growth thicket. There were still only three eggs, slightly warm. On my next visit, two days later, two of the porcelain-like shells lay near the nest site with big gaps in their sides; the third had wholly vanished. I consoled myself with the reflection that the parent bird had probably escaped, unharmed by the plunderer of its nest, for there were no feathers in the vicinity.

In the forests of El General, the Great Tinamou breeds chiefly early in the wet season, in April, May and June, to judge by the few nests that I have found and the chicks that I have met; but an empty nest which a neighbor once took me to see had eggs in late February, the height of the dry season. Although sets of six or even eight eggs — possibly laid by two females — have been reported from other regions, here I have not found more than four. In early April five years ago I discovered my third and last nest. My attention was drawn to it when a tinamou suddenly flew up, about ten feet away, while I stood watching a Chestnut-backed Antbird. Four eggs lay among loose leaves between two projecting buttresses at the base of a high tree. I did not touch the eggs, and after a few days the tinamou would continue to cover them while I looked at him from a neighboring little-used roadway. He always sat facing the trunk, and fitted neatly into the space between the buttresses.

Much as I desired to place a paint-daub recognition mark on my big tinamou between the buttresses, I doubted whether he would permit such a familiarity, and I did not wish to cause his desertion. But ten days after I found the nest,

nature herself marked the bird in a manner that I thought would be helpful. Rain began in the middle of the morning and lasted into the night. The following noon, I noticed that the dark feathers on the tinamou's rump were matted together and bore a whitish encrustation that was very conspicuous where flecks of sunshine fell upon it. This was evidently a deposit of salts leached from the plumage by the long rain and left after the evaporation of part of the water by the heat of the bird's body. The tinamou's appearance suggested that he had sat motionless, breast against the trunk, since the rain began more than twenty-four hours earlier, without even preening his matted plumage.

At last I had a marked Great Tinamou, and the opportunity for fruitful study was too precious to be wasted. Rather than disturb the surroundings by setting up a blind, I decided to make frequent visits of inspection from the neighboring roadway, along which I could pass without alarming the bird. I began at once, and on seven visits that afternoon, some of them in the rain, I found the same bird sitting.

As the next day dawned, I returned to the forest to continue my observations. As I came in sight of the nest in the dim light, the bird shot up from it with loud wingbeats. Yet I was at the same point where I had always stood; why had he suddenly become more distrustful of me? Advancing for a closer view of the eggs, I found one with a gaping hole in the side and the contents quite eaten away, leaving a conspicuous network of red blood vessels on the white inner surface of the blue shell. Another egg was intact but badly dented in two places; the remaining two were uninjured; and all three were wet and cool. Close beside the nest was a small tuft of pale feathers, evidently torn from the bird's flank. As I reconstructed the course of events, some animal had attacked the tinamou in the night; he had fled, leaving some feathers in the assailant's mouth and possibly denting the egg as he took off; then he had returned in the dim light of dawn, such a short while before my arrival that the remaining eggs had not yet warmed up.

I removed the empty and the dented shells and the blood-stained leaves on which they rested, then placed fresh brown leaves beneath the two uninjured eggs. By midday only one remained

in the nest and the empty shell of the other lay two yards away. Could the Coatimundi whom I had met in the vicinity a few days earlier have been the villain in this tragedy? Or was it the weasel that I had also seen nearby?

DESPITE THE VULNERABILITY of its lovely eggs, despite all the poachers who year after year prowl through my forest and the mauling dogs that make it hideous with their howls, the Great Tinamous have managed to survive, although in diminished numbers. Since the Crested Guans (*Penelope purpurascens*) disappeared years ago, they are the largest birds continuously present. It is easy to understand why the terrestrial tinamous have survived better than the arboreal guans. When guans are alarmed, they perch conspicuously well above the ground and yelp absurdly in high-pitched voices, a mode of behavior which is probably discreet enough when hunting Ocelots, Pumas, Tayras or other mammals disturb them, but which in the presence of a gunner is suicidal. But the tinamous rise so unexpectedly from the undergrowth, and dart so rapidly away, that the hunter who would shoot them must be exceptionally quick. The stupid pass; the wise and the wary remain.

With the guans have gone practically all of the big, yellow-breasted toucans, once so abundant in these forests, as likewise the little Red Deer, the Coatimundis, most of the Agoutis and the Tayras. Gone, too, are countless stately feather palms, felled by trespassers who carry off the pound or two of edible tissue at the growing point of each, leaving all the rest of the magnificent growth to rot on the ground. But the Marbled Wood Quail, which hugs the ground even more closely than the tinamou, has, after an interval when it had all but vanished, increased of late, now as shy of man as it formerly was trustful.

Although my forest has suffered much, it has not yet been despoiled of all its treasures. A troupe of White-faced Monkeys still roams through its tree tops, and most of the smaller birds survive in apparently undiminished numbers. Perhaps most important of all, as night falls the stirring chorus of the Great Tinamous still peals through it, proof of its enduring wildness. I think of the tinamou as the soul of the forest.



New Shows Outdoors at the Aquarium

By WILLIAM BRIDGES
Curator of Publications

The new "Tri-pool" has been built between the Aquarium and the oceanside Boardwalk. At the right is the home of "Ookie," the baby Pacific Walrus; Seals at left, Penguins behind.

THREE NEW UNITS in the Aquarium's development plan have been completed and a winter construction program that will add tanks and exhibits has been outlined. Winter is, of course, a slack season at Coney Island — but only in regard to visitors. For the Aquarium's staff it is going to be anything but slack.

The major out-of-doors addition during the fall was the "Tri-pool," a complex of three pools that at the moment are the home of "Ookie," a baby Pacific Walrus, ten Harp and Harbor Seals and half a dozen Humboldt Penguins. They are big pools; the Walrus swims in a crystal-clear sea with a 15-foot radius; the seven Harbor Seals have an oval home 50 feet long and 30 feet wide, and the penguins have a pear-shaped pool 40 feet long

narrowing to 14 feet at the end. A huge circular canopy shades the pools in summertime and we foresee no difficulties on account of heat, for the water that circulates through the pools — either salt or fresh — comes in cold and keeps moving.

It has been obvious from the very beginning of the Aquarium at Coney Island that restaurant facilities on the upper deck were going to be swamped when hundreds — and sometimes a thousand — school children pass through the Aquarium in one day. That mealtime congestion has now been taken care of by the building of a big picnic area, gaily decorated with ship's masts and signal flags. There is table and bench room under the masts and between them for some 300 persons. All the usual light refreshments will be available in a small building in the picnic area itself, from vending machines.

To ease the flow of traffic through the Aquarium's halls, the former entrance-exit has been restricted to an entrance; the exit is now outside the main building, through a new and attractive souvenir building. A series of small tanks will be set up this winter in the entrance lobby, in the space formerly occupied by a souvenir and information desk.

Still other tanks and exhibits — a tide pool, for instance — are being planned for the out-of-doors and will be built by the Aquarium's own people during the winter.

Any modifications that involve moving great amounts of water are slow. But the ones now made and to be made are important and will give the Aquarium a bright and busy look when the Coney Island season begins again this coming spring.



Glass-enclosed on three sides, the souvenir building serves as an exit — a much better arrangement than before, when visitors had to leave the Aquarium by a turnstile at the entrance gate.



Colorful signal flags flying in the sea breeze mark the site of the picnic area unmistakably. The building in the background will contain food vending devices.

CONSERVATION

FOUNDATION



George Wall Merck

George Wall Merck was graduated from Hamilton College in 1940. During World War II he served as Operations Officer on Cruiser Staff and Gunnery Officer of a destroyer in both Atlantic and Pacific operations. After the war he worked extensively in Africa and Europe and for extended periods was a resident of Canada, Mexico and Brazil, as a representative and officer of Merck & Company, Inc., manufacturer of pharmaceuticals.

Mr. Merck became Secretary of the New York Zoological Society on June 18, 1959. He was made Secretary of the Conservation Foundation in the same month, confirming in practice his own belief that it is impossible to be a member of the New York Zoological Society and not take an active interest in its younger affiliate.

A director of the American Forestry Association, he is also United States Secretary of the International Council for Bird Preservation and a very articulate exponent of the importance of wildlife conservation.

Pesticide Conference

Aware of rapidly mounting interest both public and academic in the pesticide problem, the Foundation sponsored a conference on "Implications of Increasing Use of Chemical Pesticides" on November 16-17. The conference, made possible by a grant from the Rockefeller Foundation, was under the general direction of Stephen W. Bergen, Assistant Director of Research. Chairmen for the two-day session included Samuel H. Ordway, Jr., Executive Vice-president of the Foundation, and Frank Fraser Darling, Vice-president and Director of Research.

The conference dealt with ecological effects of pesticides, suggested biological control and insect resistance. The purposes of the conference were to identify special situations where further research is urgently needed and programs in which the Foundation might take active leadership in helping to resolve a situation which so evidently threatens wildlife and, indeed, the entire biotic environment. The conference was attended by twenty-two individuals who have had special experience and knowledge in various aspects of this problem. Those attending represented universities in the United States and Canada, members of the U. S. Department of Agriculture, U. S. Fish and Wildlife Service and the U. S. Public Health Service, and officials of corporations producing chemical pesticides.

Area Resource Development

The research division will undertake a series of research studies and pilot projects in local areas where pressures and plans are forcing changes in land use. Wallace D. Bowman, Assistant Director of Research, will be in charge of the project. It is proposed to bring local planners together with resource technicians and demonstrate the value of their collaboration in pilot areas.

Because hard-pressed economies in some areas stem from misuse and underuse of resources, it

is believed that conservation knowledge is often overlooked in local and regional efforts to speed up economic development. By publishing research memoranda showing the role of specific resources and resource management in economic planning and development in specified areas, it is believed that this area resource development program will make more efficient the alliance of conservation practices with work undertaken by local groups as well as state and federal agencies. A technical advisory committee will be selected to consult on pilot projects and members of this group will be selected from experts who have had broad experience in local and regional economic growth, resource management, planning, public administration and ecology.

Briefly Noted

Dr. Paul Brandwein, director of Education, has returned from a West Coast trip which included a major address on "The Basic Resource," given before the Outdoor Education Association on October 17 at Idyllwild, California. . . . Third quarter royalties for Foundation films which have

been circulated among schools in the United States and Canada amounted to \$3,961, the highest in six years. . . . Wallace Bowman attended a forest products marketing and utilization seminar at Lansing, Michigan, November 3-5. He reports the conclusion of the conference to be a need for additional research and aggressive marketing in the wood products industry to assure adequate competition with other industries as well as a better utilization of our wood resources. . . . Requests for copies of "The Pesticide Problem" by John George have been so numerous that a second printing has been authorized. . . . 5,000 samples of the Foundation's test to determine growth of understanding among students on the subject of conservation have been sent to the State of Oregon for distribution among Junior and Senior High Schools in rural, urban and metropolitan districts. This trial run is to ascertain the grade level of efficient administration of the tests. . . . Roger D. Hale was chosen Vice-chairman of the Natural Resources Council of America at a meeting held October 9-10 at Blackwater Falls State Park in West Virginia.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Jimmy Sets a Record

Jimmy the Kinkajou (*Potos flavus*), a slow and gentle little member of the raccoon family from tropical America, seems to have established a world's record for longevity of his kind when he died of tuberculosis on September 24. He had been in the Zoological Park's collection for 22 years and 18 days, and was adult when he came to us on August 6, 1937.

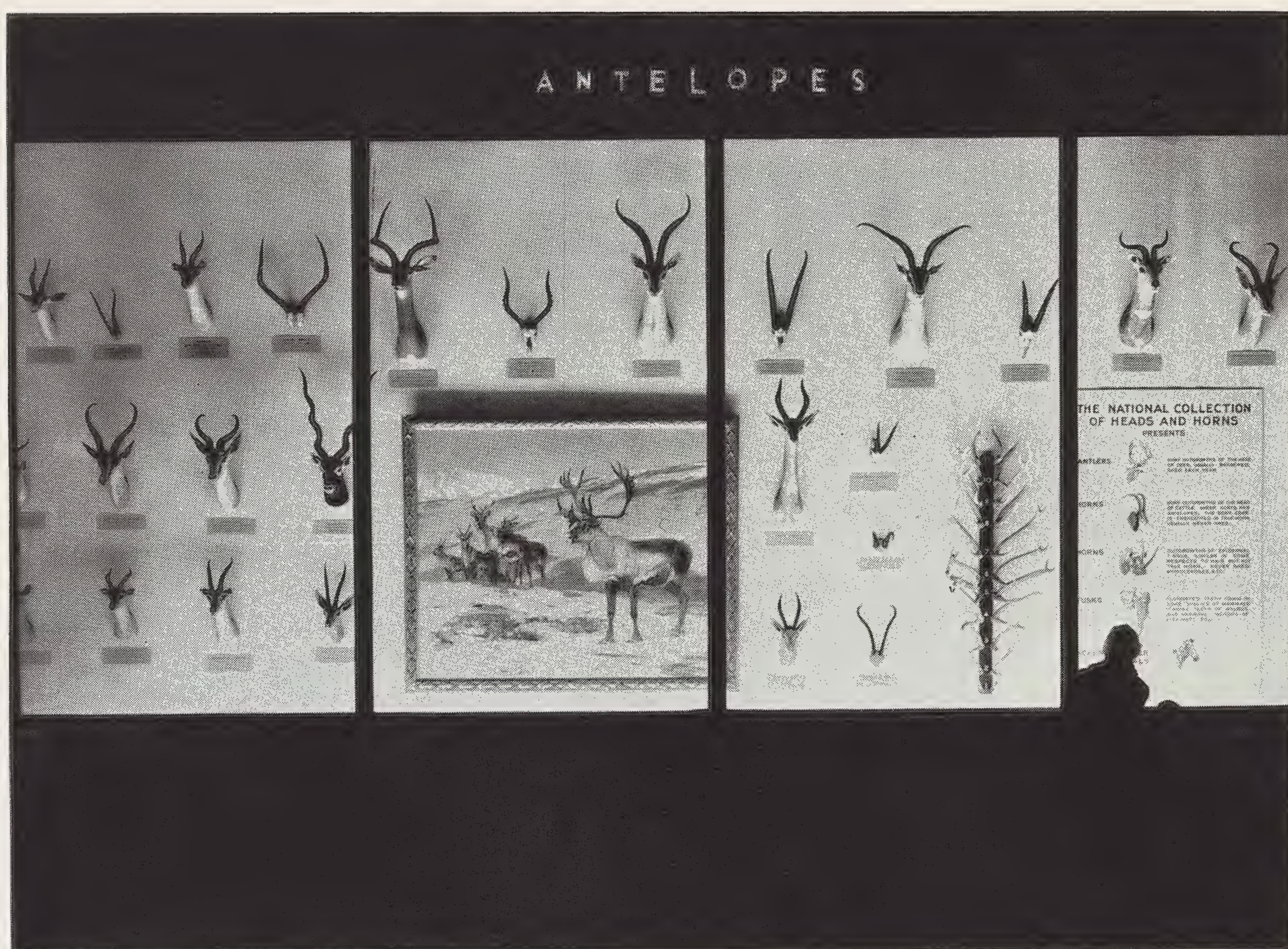
He lost the sight of his left eye by a child's thoughtless action at the New York World's Fair in 1940, but because of his placid nature he was kept on exhibition and was for several years a favorite among small animals taken to schools by our Education Department. In recent years, as he approached the known longevity record, he was allowed to live a quiet and undisturbed life in the Small Mammal House.

The best previous record is for a Kinkajou that lived in the London Zoo for approximately 21 years and 10 months.

Spectacular New Birds

Three species of birds apparently never before exhibited in the United States have been received from the Belgian Congo through Charles Cordier, the animal collector. Most spectacular is the Giant Blue Touraco, which lives high in the forest trees and is difficult to capture and to keep in captivity. We have two.

The other rarities are Ross's Violet Touraco and the White-crested Hornbill. Mr. Cordier first captured the Giant Blue Touraco in 1948 when he was collecting in the Belgian Congo for the Zoological Society, but never got one out alive.



Brightly but not glaringly illuminated from below as well as above, the new wall exhibits in the Heads and Horns Museum invite attention. Rungius paintings hang on several of the walls.

Heads & Horns Museum Reopened On Zoo's 60th Anniversary

The Zoological Park observed its sixtieth anniversary on Monday, November 9, by reopening the Heads & Horns Museum which had been closed for remodeling since August 1, 1955. The actual anniversary of the Park is November 8, the date on which dedication ceremonies were held in 1899, but the first full day of the Zoo's operations was November 9.

The Heads & Horns Museum, for many years a dream of Dr. William T. Hornaday, the Zoo's first Director, and Madison Grant, a founder and President of the Society from 1925 to 1937, was opened in 1922 to house what was called the National Collection of Heads and Horns. It was conceived of as a "memorial to the vanishing big game of the world," and was soon filled with trophies given by American sportsmen. Some were record heads, or exceptionally good, but

many others were inferior duplicates and the two large halls eventually became cluttered.

Under the general supervision of General Director Tee-Van a complete overhaul was undertaken. Preliminary advice was obtained from Dr. James L. Clark, for many years director of preparation and installation at the American Museum of Natural History. Subsequently Samuel S. Webb and the late Alfred Ely of the Society's Heads & Horns Committee began the redesign of the exhibits, and Mr. Webb and Grancel Fitz of the Boone & Crockett Club determined the form of the North American collection. Heads worthy of exhibition were selected by T. Donald Carter of the American Museum of Natural History, and Harold C. Casey of Bangor, Maine, an expert taxidermist, was engaged to recondition the heads, horns and antlers — in much reduced numbers — finally chosen as representative of the large mammal fauna of the world. The result is an attractive, world-wide collection.

IN BRIEF

Dr. Beebe to Trinidad. Dr. William Beebe and the staff of the Department of Tropical Research left by air on October 26 for the Department's field station at Simla, in the Northern Range of Trinidad.

Fall Closings. The Children's Zoo, which opened on March 28, closed on November 11 with an attendance of 339,344, the best in six years. A record for the highest paid attendance in its history was made by the Farm-in-the-Zoo, with 99,308 visitors. It opened April 4 and closed October 12, a month earlier than usual.

Bird Statistics. Having occasion recently to summarize records of the Bird Department, Assistant Curator Davall discovered that the Zoological Park has exhibited 2,942 species or subspecies of birds since 1899. The first specimens were accessioned on May 27, 1899.

Air Conditioning for Reptiles. Air-conditioning apparatus is being installed in the southeast section of the Reptile House. Night temperatures in the tropics often range between 65 and 75 degrees Fahrenheit, considerably lower than the 80-95 degree range of the building that is ideal for many other reptiles. It is hoped that the lower temperatures will stimulate some difficult snakes so that they will feed regularly.

Conway Advises in Jamaica. Curator Conway of the Bird Department spent five days in Jamaica in October as advisor to the Jamaican Ministry of Agriculture on the development of a zoological park in the Royal Botanical Gardens.

Ray with "Calypso." Dr. Carleton Ray of the Aquarium staff spent 11 days aboard Capt. Jacques-Yves Cousteau's oceanographic vessel *Calypso* in October, observing the tests of a new type of "diving saucer" that can be used for exploration, collecting and photography at depths of 300 metres.

PUBLICATIONS OF INTEREST

A NATURAL HISTORY OF NEW YORK CITY. By John Kieran. Illus. by 78 black-and-white drawings by Henry Bugbee Kane. 428 pp. Houghton Mifflin Co., Boston, 1959. \$5.75.

John Kieran has been so well known to "bird watchers" of this area for so many years that he has long been an accepted member of that fraternity. When a migrat-

ing Lapland Longspur arrived on the parade ground in Van Cortlandt Park, it was he who saw it first. When there was word of an avian rarity in any accessible area, arriving searchers might be certain that a slightly venerable black Cadillac, parked in the nearest available spot, would inform them that Kieran had come before them. With such a background it might be supposed that birds would occupy most of the present volume but actually only 82 pages of a text of 396 are wholly ornithological. For this author is a man of broad interests and in covering the natural history of New York he has missed nothing. From a concise but informative history of the City itself, he moves on through geology, geography and climate to small aquatic creatures, insects, trees, mammals and, finally, to birds. A wide field, to be sure, but covered so skillfully that the budding interest of the novice will not be stifled by long lists of names and descriptions. Instead, there is information enough to stimulate a further quest for knowledge. There need be no doubt as to accuracy, for whenever the slightest question arose, the best authority within reach was promptly consulted; every institutional curator in the New York area must have contributed in some way to this mass of accumulated — and digested! — information. Through it all, there is evidence of the obvious pleasure John Kieran takes in passing on to others some of the enduring fruits of a pursuit which has absorbed so many years of his life. — L. S. C.

COMPLETE FIELD GUIDE TO AMERICAN WILDLIFE: EAST, CENTRAL AND NORTH. By Henry Hill Collins. Illustrated by Russell Francis Peterson, Nina L. Williams and John Cameron Yrizarry. 683 + xix pp., 740 species illus. in color, 800 in black and white, many maps. Harper and Brothers, New York, 1959. \$6.95; \$7.95 in deluxe flexible binding.

This book attempts to present a combined guide to the land vertebrates and the food and game fishes occurring throughout North America north of North Carolina, Tennessee, Arkansas, Oklahoma and New Mexico, east of the Rocky Mountains. Many marine invertebrates, the sea shells and the food and game fishes, to a depth of 25 fathoms, of American Atlantic and Arctic coasts from North Carolina's northern border to northern Canada are included. Accounts of 1,439 species are presented in the following groups: 454 birds, 192 mammals, 98 reptiles, 76 amphibians, 342 fishes, 149 mollusks and 128 other marine invertebrates.

A fore-edge patch guide makes quick location of major animal groups possible despite the enormous number of species included. As might be expected in such a compendium, the quality of the species accounts varies, and the book certainly owes much to its field guide predecessors. The illustrations vary in quality. The fishes by Nina Williams are well done but the mammals, reptiles and birds are not up to the high standards set by the recent Peterson, Pough, Burt and Conant field guides. — W. G. C.

WATER STREET U.S.A. By William H. Carr. 72 pp., 49 illus. Arizona-Sonora Desert Museum and Charles Lathrop Pack Forestry Foundation, Tucson, Ariz.

Bill Carr, as visitors to the Trailside Museum at Bear Mountain may know (for he made it what it is today), has a genius for getting ideas and information into people's heads. Pushbuttons that deliver a recorded story or actuate some simple device, guages, pungent labels, gimmicks of endless variety and ingenuity are his stock in trade. He makes people *enjoy* learning about nature! Founder and now Director Emeritus of the well-known

Arizona-Sonora Desert Museum, he is the creator of the Watershed Exposition of the Museum, popularly known as "Water Street U.S.A.," which uses a Carr-ful of devices to tell people about water and its influence on their land and lives. This brochure, written by Carr, is a lively guide to the new exhibit in the desert near Tucson.

ALL THE BIRDS OF THE BIBLE. By Alice Parmelee. 279 pp., 64 illus. Harper & Brothers, New York, 1959. \$4.95.

The Bible contains some 300 references to birds, some specific but many of the vaguest kind. Certain birds can be identified surely, others guessed at, and around them all Miss Parmelee weaves Biblical stories, legends and straight ornithology. An excellent Christmas present for a bird-watching minister friend.

ZULU JOURNAL. By Raymond B. Cowles. 267 pp., 78 illus. University of California Press, Berkeley and Los Angeles, 1959. \$6.00.

Of technical and special-pleading books about Africa there is no end. This is not one of them (although it is, significantly, dedicated to Malthus.) It is a wise, leisurely, sympathetic, understanding journal by a professor of zoology at the University of California who learned Zulu as a missionary's son in Natal, a compound of boyhood recollections and acute and often nostalgic observations made on two visits in later years. Ostensibly it is a book about animals, particularly in the Hluhluwe Valley, but it will be greatly valued by many for its sensitive recapturing of sights and sounds and smells and colors, and its affectionate feeling for the people.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1959)

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Mrs. Lee A. Ault

Milo Waldes

Contributing

Mrs. Louis K. Anspacher

Mrs. Harold d'O. Baker

Martin Birnbaum

Frederic H. Brandi

Philip Carlinger

Jesse D. Clarkson

Dr. Gabriel A. Covo

Norris Darrell

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Dr. Douglas G. Gemeroy

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Georges B. Hodac

David D. Jacobus

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Mrs. Sidney Legendre

Mrs. Bernard W. Levinger

Milton Lowenstein

Frasier W. McCann

Ernest H. Meili

Dr. James S. Murphy

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Sylvan Oestreicher

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Jerry Bailin

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Miss Nadia Chlepner

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E. L. Cleverley

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Joseph T. Collins, Jr.

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Philip M. Davis

Mrs. Fairman R. Dick

Joseph W. Drake

Morris Fox

Mrs. Mary Ann Fraser

Dr. Frederick F. Friedenberg

Richard M. Garten

Mrs. Roger L. Greif

Morton Harfenist

Mrs. Glory Harris

Mrs. Helen Hasselriis

S. Alexander Haverstick

Don Herbert

John S. Hilson

Jerry Hirsch

Fred Honer

Dr. Milton H. Horowitz

Mrs. Ella J. Hough

Mrs. Richard Kelly

Carl L. Kempner

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C. M. Kibbee

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Mrs. Joseph Krimsley

Carl R. Lawson

Mrs. Howard Lehman

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William Jay Lippman

William H. Loery

Clarence H. Low

Mrs. Sue Davidson Lowe

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Denis B. Maduro

Stewart Maurice

Thomas C. Mayers

Mrs. Rose Meckler

Richard G. Merrill

Dr. John D. Mitchell

J. T. Moll

Mrs. Elaine E. Moss

Miss Katharine Prentis Murphy

Roswell C. Otheman

Norman B. Perlov

William M. Perry

Mrs. Jane Cox Ponty

Miss Faye Pratt

Mrs. Max Pruzan

Jacob Rassner

Seymour Reitknecht

Victor Remer

Dr. Seymour L. Romney

George Rosenthal

Miss Cecylja B. Rother

Mrs. Teviah Sachs

Mrs. Douglas Smiley

Howell B. Smith

R. Brinkley Smithers

Julian Speyers

Lyle Stuart

Mrs. Jeanne Susskind

Kenneth C. Tapman

Miss Christie Thompson

Louis Frederick Wade

Miss H. C. Wagner

Mrs. Edward R. Weber

Leonard W. Weinrib

Stanley Weinstein

Mrs. Gerard Weinstock

Trevor B. Wilfert

Mrs. Jerry J. Williams

Dr. Herbert G. Winston

Mrs. Alling Woodruff

Fellow

Dr. L. Floyd Clarke

Capt. Jacques-Yves Cousteau

I N D E X

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The 365th Day

Is January 7

For 364 days of the year the east foyer of the grand ballroom of the Waldorf-Astoria leads a normal life. But on the 365th day everything changes with the advent of the Zoo and Aquarium's birds, mammals, reptiles, fish and amphibians. They take the place over with a burst of animal spirits that is irresistible.

This winter the invasion date is Thursday evening, January 7, 1960.

Inside the grand ballroom you'll see movies of a lot of animals we couldn't bring with us to the party. It's as stimulating a group of motion pictures as we've ever produced, taking you from New York to Burma, Trinidad, and Alaska. It ought to be quite an evening, and we hope you'll surely be there with us.

Incidentally, it gives you, as a Member, a wonderful chance to introduce your friends to the New York Zoological Society. And that's why, although guest tickets as usual are in short supply, we can always find one for any prospective Member you may wish to bring.



ANIMAL KINGDOM

NEW YORK ZOOLOGICAL SOCIETY



VOLUME LXIII

JANUARY TO DECEMBER, 1960

Numbers 1-6

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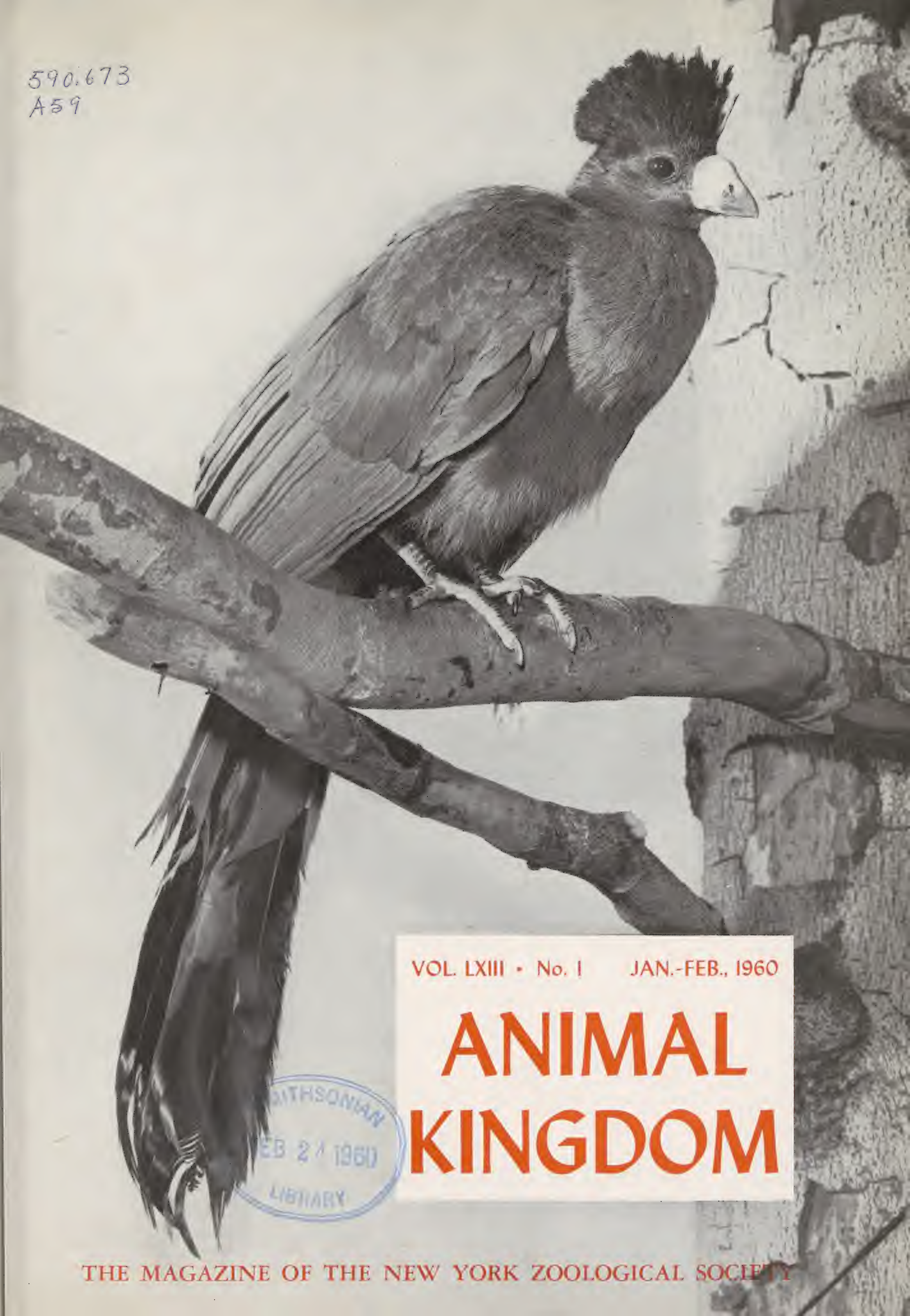
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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

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New York
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Gala Performance

IN ANY GREAT CITY, innumerable meetings and gatherings occur. Some are for political or commercial purposes, others for a great variety of philanthropic causes. New York goes out for such affairs in a big way.

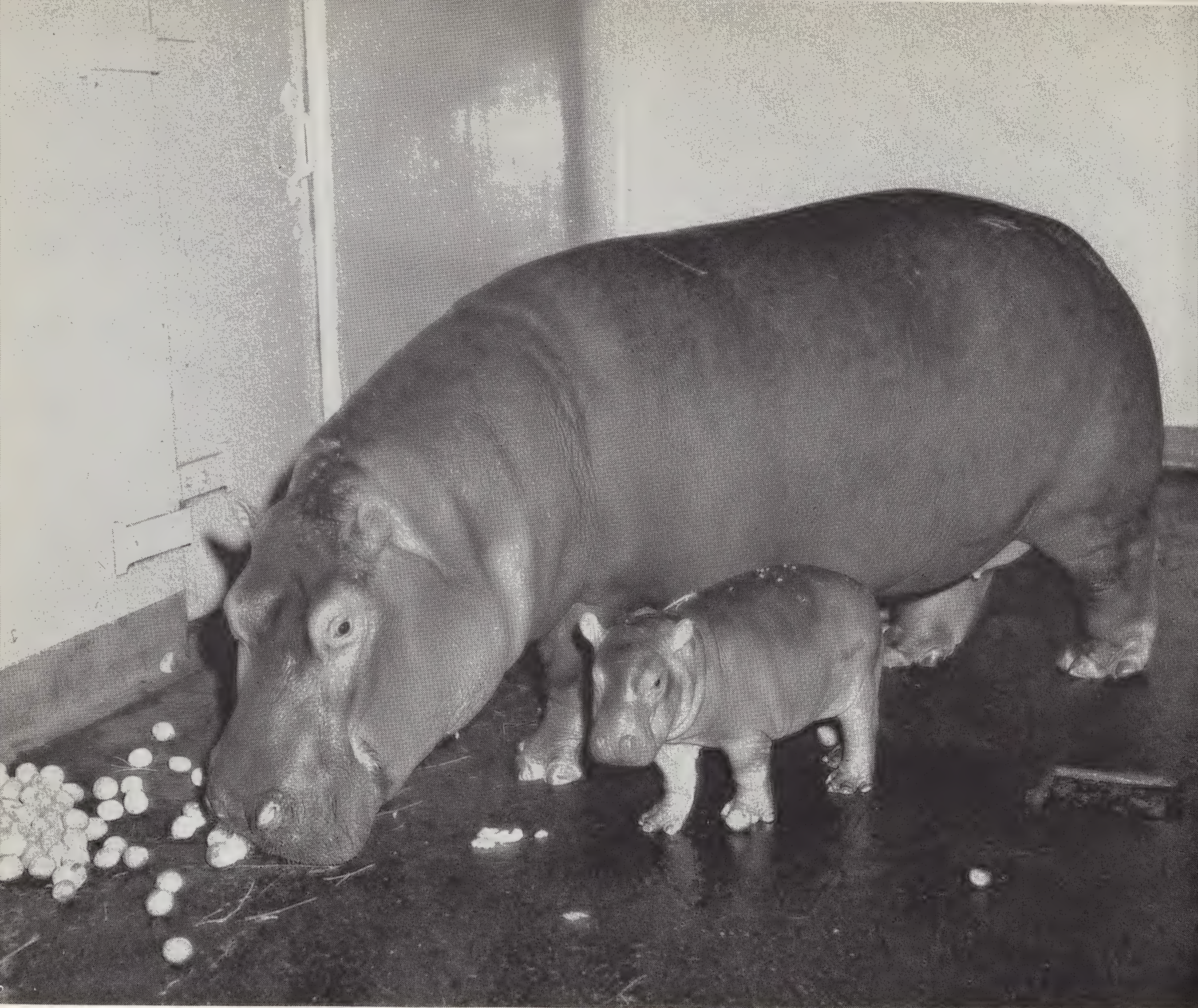
Because of its central location, its design and its seating capacity for some 2,000 people, the Grand Ballroom of the Waldorf-Astoria has become the mecca for notable meetings in this vast city. For more than sixty years, except for a brief interlude, our Society has always held its Annual Members' Meetings there — first in the old Waldorf on 34th Street and since 1932 at the present one. The phrase "gala performance" is somewhat overworked, but actually our meetings always seem to reach the rarified altitude of enjoyment and interest of such an occasion. Once more, on the 7th day of the present year, some 2,000 members and friends of our Society gathered together — the great room filled to the very last seat. For what and for why? To greet some foreign dignitary or to advance some cause or purpose of lesser or greater importance? Not at all — no indeed. All were there to revel in an evening devoted to the wonders of animal life and, in passing, to cheer our Society on to an ever-brighter future of accomplishment.

Fairfield Osborn

THE COVER

Among the more spectacular birds of the Belgian Congo's forests are the Giant Blue Touracos — also known by the name of the Giant Plantain-eater and "Bulikoko," a native name. Familiar as it is in the heart of Africa, it is extremely rare in zoological collections and this specimen is the first exhibited in America. It was caught for us by Charles Cordier.

SMITHSONIAN
INSTITUTION FEB 15 1960



The First Baby Hippopotamus In Sixty Years!

By WILLIAM BRIDGES
Curator of Publications

BABY HIPPOPOTAMUSES are not quite a dime a dozen, but they are certainly no great rarity in most large zoos. Consequently the birth of a baby (a female, we think) to our Peter II and Phoebe on December 16 might seem comparatively unimportant if it were not for a special circumstance: it is our first living young one, the first in sixty years!

We have the best possible excuse. Until 1956 the Bronx Zoo never had a pair of Hippopotamuses — only old Peter the Great, a lifelong bachelor. No babies, therefore. Peter the Great lived for 49 years, 6 months and 19 days, and within a few months after his death the Zoo began casting around to acquire a pair of young Hippopotamuses, having in mind just the sort of

thing that happened so successfully on December 16.

As a matter of fact, this was Phoebe's second offspring; her first calf, a 53-pound male, was born dead on December 23, 1958.

The gestation period of the Hippopotamus is eight months, with a few days' leeway in either direction, and the birth was tentatively figured for mid-December. On December 13 its imminence was confirmed, for on that day Phoebe began a noisy and almost continuous squabbling with her mate, chasing him away from her with vicious lunges and up-sweeping motions of her head. She bellowed and roared with wide-open mouth and as she slashed upward with her long lower teeth she gave Peter several glancing blows that broke the skin. Her determination to drive him away was so frenzied on December 15 that the two animals were separated, Phoebe being locked in the pool and Peter confined to the stall above the pool. He did not take kindly to his exclusion from the warm water, but with a heavy iron gate barring access to the steps, and Phoebe lying at the foot of the steps and roaring at him, there was nothing he could do about it.

Where Phoebe goes, there the baby goes — generally a little back of her head, where she can keep an eye on it but sometimes actually under her chin. Baby gets well away when Phoebe roars at her mate.

On the morning of December 16 Phoebe and Peter were continuing to bellow at each other and since it was obvious that Phoebe would not feed peacefully while her mate was nearby, Peter was turned out of doors. The weather was mild and bright. Phoebe then climbed the stairs and began to eat from the mound of hay, grain and vegetables on the floor of the stall.

At 9:10 a.m. she returned to the pool, swimming slowly and restlessly. The water was low — only about 18 inches deep, for the keepers had drained it and quickly scrubbed it while she was feeding. At 10:05 a.m. there was a small "plop" and a threshing sound, and an instant later a baby Hippopotamus's head popped to the surface and, with a typical Hippo gesture, wiggled its pinkish ears.

All this time the pool was being filled with warm water as rapidly as possible. The rushing

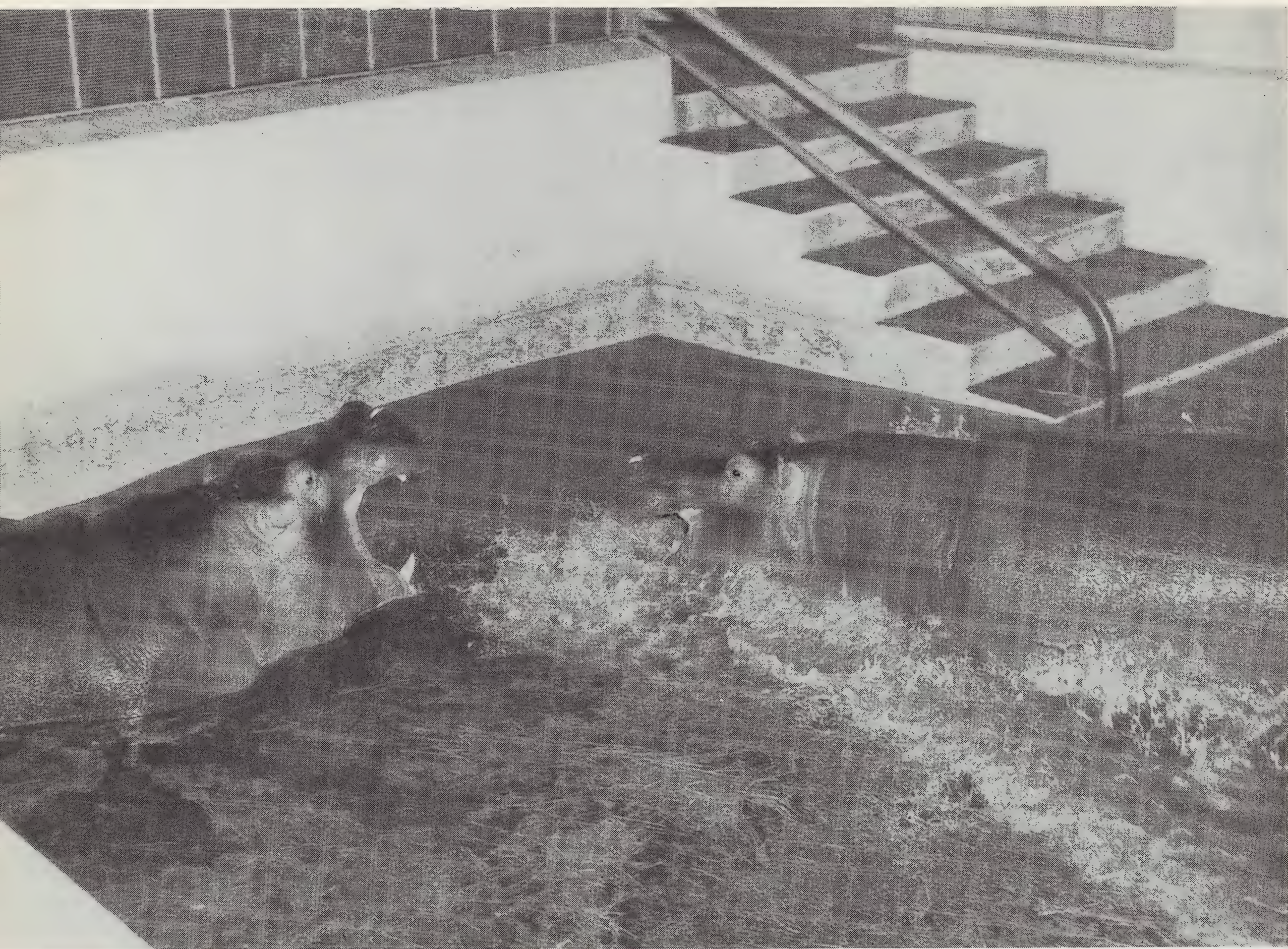
of the water and the trumpeting and door-banging of the elephants at the other end of the building — vain attempts to impress upon their keepers that they had not had all the breakfast they wanted — seemed not to disturb Phoebe in the slightest. She lay in the far corner of the pool, where the heating pipes kept the water warmest, and for the most part penned the baby between her body and the wall. Her movements were slow and deliberate and probably she knew at every instant just where the baby was, although to observers on the edge of the pool it seemed several times that she must surely "squash" the baby against the wall.

Hippopotamuses normally are born under water and nurse under water. Phoebe's offspring was born in the water, rather than under it, on account of the low stage of the pool, but it filled rapidly to its normal depth of three feet and during the day the baby nursed. Phoebe was seen to lie down, the baby went below the surface, and on one occasion stayed down for about 40 seconds. Its first observed nursing period was at 12:30 p.m., a little more than two hours after birth.

The patient father, by this time hungry and anxious to get into the heated pool, was allowed back in the building early in the afternoon. His reappearance was the signal for Phoebe to begin her bellowing and head-tossing all over again.

There could be no question of allowing Peter to go down into the pool, for Phoebe stood guard at the foot of the steps and made her intentions clear. For the next four days Peter raged against her injustice. He reared ponderously against the bars that separate the stall from the pool, he slashed at the bars until bits of teeth splintered off, and he shoved with all the force of his ton-and-a-half body against the pool gate. After four days he gave up trying.

It is very bad form in the scientific world to say that an animal is dispirited, discouraged and sad; those are human terms and animals are not people. But Peter II *looked* dispirited, discouraged and sad, and he acted as if he were. His eyes grew lack-lustre, he stood for hours on end with his chin resting on the floor of the stall, he made few and brief attempts to eat. Sometimes he sank down beside the stone feeding trough with his chin resting on it, as it had so often



rested on the soft pillow of Phoebe's back, and he stared unwinking and unmoving at the blank wall. The Zoo staff felt sorry for him, but there was nothing it could do except to rig up a spray of warm water and give him a shower bath all day long — a poor substitute for the pool that would have buoyed him up and taken some of the weight off his feet.

For the first two days Phoebe was fed on the bottom steps of the pool but on December 18 the pool had to be drained for cleaning and Phoebe and the baby climbed the steps and were in the stall with Peter. Phoebe roared as she came up the steps and was apparently determined to give Peter a hard time every minute of her stay out of water. She was allowed up again on December 24 and seemed slightly less aggressive.

On December 29 she was allowed upstairs once more and then she made a mistake; tempted by the hay and grain in a far corner, she turned her back for an instant, and Peter lumbered to the

The sound is lacking but there is no doubt about the fury when Peter (on the left) slipped into the pool for his first soak in days.

The pool had been drained in order to force Peter upstairs but he simply lay down on the floor and defied keepers to move him.

stairs and down into the pool. Phoebe saw too late what he had done, and went roaring after him, with the baby close behind. But it was Peter's first opportunity to soak and he refused to budge from a protected corner. It was a precarious soak that he enjoyed, however, for every time he made a motion as if to roll, Phoebe came at him with open mouth and he had to stay alert and ready to roar back.

At 3 o'clock that afternoon, knowing that Phoebe and the baby needed the pool worse than

Peter did, the keepers drained it and with shouting and prodding with brooms finally forced Peter to vacate. It seemed for quite a while that they were not going to be able to dislodge him, for at one stage he simply lay down on the floor of the empty pool and resisted all urging to get up and go.

Go he finally did, nevertheless, and after a few resentful roars Phoebe and the baby settled down in the water. Not until January 5 would Phoebe tolerate Peter even in the stall without bellowing at him continuously, although she was forced to go upstairs every day for feeding. Indeed, she got very little to eat herself, being so preoccupied with keeping an eye on Peter and making sure he did not slip into the pool again.

The baby took no part in this family quarrel. When Phoebe roared and tossed her head, the

youngster usually scuttled to the far side of its mother, out of the way of anything that might happen.

But such violent antipathy between the sexes cannot go on forever, else the Hippopotamus race would cease to exist. Phoebe grew more and more tolerant, and on the morning of January 12, one day short of four weeks after the birth of the baby, Peter quietly descended to the warm and soothing water of the pool while Phoebe was feeding in the stall, and she made no protest.

PHOEBE'S solicitous care for her offspring has created one kind of problem; the opposite maternal attitude in an Agile Wallaby has created another.

On October 7, one of the Agile Wallabies in the Kangaroo House was seen to be carrying a





“joey” in her pouch. Another Agile was known to have a baby of about the same age.

Things went along normally for several weeks and then, at the end of November, both babies were found in one pouch. Knowing that one-to-a-pouch is the rule among Kangaroos, keepers tried to restore the excess baby to its own mother, but she would have none of it and quickly removed it from her pouch.

Attempts have been made several times in the past to rear orphaned or abandoned “joeys” by hand, but seldom with success. Usually they were too young to “transplant” successfully to an artificial pouch.

In this instance, the joey — a female — was several weeks old and quite large enough and vigorous enough to survive. On December 1

Snugly wrapped in cloth and tucked inside Mr. Davis’s sweater, the little Agile Wallaby (a female) is always motionless and perfectly at home, however suddenly her “mother” moves.

Photograph by Martin Iger

Associate Curator of Mammals Davis wrapped the baby in a warm towel and took it to his home in New Jersey, where an artificial, knitted pouch was soon prepared for it. The baby is thriving and growing. Several times it has been brought back to the Zoological Park, well wrapped up and with only its head protruding from the bundle under Mr. Davis’s sweater. It is quiet and unafraid, restless only when feeding time approaches and making sucking motions with its lips while its bottle of cow’s milk is being warmed.

Streamer-tail Expedition—

How to Catch a Shooting Star

By OLIVER GRISWOLD

*Coordinator of Radio, Television and
Film Dept., University of Miami*

THREE STREAMER-TAIL HUMMINGBIRDS that have charmed many visitors to the Bronx Zoo's Jewel Room were products of my first adventure in bird collecting. Remembering my first sight of Streamer-tails, I am still amazed at my success in catching them.

I made their acquaintance at Strawberry Hill, 3,000 feet up in the mountains above Kingston, Jamaica. (Jamaica, incidentally, is the only place where Streamer-tails are found, although there are seventeen species of hummingbirds in the Caribbean). Our bird is *Trochilus polytmus*.

Mrs. Griswold and I had strolled out in the exhilarating coolness of the mountain air and we had walked scarcely fifty feet along the precipitous edge of the hilltop garden when there, on a bare twig of a cedar overhanging the face of the mountain, was a male Streamer-tail. It was surprisingly large — almost ten inches long, including the streaming tail. Its head was velvety black, its back a bronzy-green, and the tail and two long streamers also black. A somber little bird, you might think, until it turned and you caught the vivid glory of the emerald green breast that sometimes reflected the light as if it were metallic and at others seemed infused with an inner, glowing light.

I tip-toed back and beckoned to Mrs. Griswold. As we watched, his two streamers pulsed slightly in rhythm with each gentle breath and the afternoon sun lighted up his shining red, needle-like bill. Then he turned to look at us, raising his velvety crest and revealing the glitter of his breast.

With a sharp *tzeek* he whirled off in a rising

One of the Streamer-tails Mr. Griswold sent to the Bronx Zoo is shown here seemingly dancing in mid-air. We have three of these dazzling beauties, all males — and kept separate!





arc, out over the mountainside. At zenith he cried *tzeek tzeek* and put on top speed. As a trim meteor with black comet tails he diminished to a speck and vanished in the blue space over the valley.

Knowing that I was supposed to catch Streamer-tails for the science program of the University of Miami television show, Mrs. Griswold looked thoughtfully at me.

"How *do* you catch a shooting star?" she asked.

I found the answer to that question eventually, but I also learned a number of other interesting things about Streamer-tails.

* * *

THE MALE STREAMER-TAIL is not only ornate and gorgeously colored, but also violently belligerent. This is a characteristic of many species

of hummingbirds, but the Streamer-tail demonstrates it most dramatically, notably in jealously protecting its feeding territory.

Repeatedly we watched one who "owned" a particularly rich segment of the Strawberry Hill garden. After feeding a few minutes from flower to flower, he would helicopter up from the final blossom and hang stationary on blurred wings while he surveyed his domain.

Next he zoomed up to a high watch-tower, a dead twig under the shade of overhanging cedar boughs. On this cool perch his brilliant coloring virtually disappeared and as he kept an eye on his realm, he was almost invisible in the shadows.

Within three or four minutes, usually, another male Streamer-tail arrived, peered cautiously about, and started purloining from the blossoms.

The "owner," as though unable to believe his eyes, at first simply stared at this rash effrontery. Then, with a ringing battle-cry of *tzeek tzeek tzeek* and a curious, rattling whirr of his tail feathers, he attack-dived upon the interloper.

If the intruder hesitated, a few smart, battering wing-whacks were sufficient to impell him into headlong flight. I never saw one stand his ground. The outraged "owner" pursued with might and main, whacking with wings and *tzeeking* furiously. Over the brow of the knob they whizzed, instantly dwindling to motes and vanishing with the impression that their momentum would carry them on for miles.

Now the area was still and peaceful. Gradually, a Bananaquit here, a Tody and a Yellow-faced Grassquit there, would appear in the shrubbery. For a short while they would hop busily among the branches, feeding rapidly until another Streamer-tail appeared.

The Streamer-tails constantly harried the black and yellow Bananaquits and the glittering, grass-green Todies. But these docile birds always melted quickly into the protection of the shrubbery.

We discovered the Streamer-tail that claimed

At dusk, small clouds of gnats emerged from the foliage between these two cedars and then the Streamer-tails fed heavily, snapping their final meal of the day and hovering like helicopters.

Photograph by Oliver Griswold

the territory by no means had clear title. If he were away overlong in pursuit of a trespasser, another was certain to slip in to chase out the Todies and Quits and sip happily until the "owner" returned to route him. Also, we learned that the "owner," himself, was a claim-jumper in other territories.

Many times we saw him rushing back in panic, chased around the curve of the mountain by the lord of another domain, *tzeeking* and whirring indignation. All day the slopes of Strawberry Hill were enlivened by the streaking tandems of green comets. Yet not once did we see any clinch in mortal combat.

One day, while a hibiscus hedge was being trimmed, a Streamer-tail nest with one naked nestling was discovered. We watched it until the little fellow developed to the stage of standing on

the edge to flicker his pin-feathered wings. Then, with infinite gentleness, Vincent Walker, the flower-bed gardener, tied a soft, cotton string around his spindly left tarsus and fastened the other end to the nest. The mother continued to feed with undiminished zeal.

We visited the nest regularly, and Mrs. Griswold dubbed the gangly youngster "Hilton Hummingbird."

As "Hilton" developed, he tried one flight of three inches, which was the length of his tether. I put him back on the edge of the nest, and he never jumped again. How this "bird-brained" midget could so quickly learn that he was tied, I have never understood.

One night, when "Hilton's" mother was no longer brooding him, although she was still feeding him, down came a torrential rain. I visualized the poor little fellow as drenched and chilling, so with flashlight and umbrella I groped through the storm to discover "Hilton" sitting perkily on the edge of the nest, his stubby baby bill pointed up in the air and his well-oiled feathers shedding every drop perfectly. Nevertheless, I "rescued" him, took him to our room, and tethered him to a twig on top of the bureau.

I proceeded to give him lessons in drinking from a test tube. This took a bit of patience, for hitherto, his natural eating position had been with head raised and mouth wide open, while his mother rammed in her long bill to the hilt and pumped in food. The youngster had trouble understanding that now he must tip his bill down. But once he tasted the delicious mixture, he needed no instructions in drinking. His instinct for lapping and pumping was in perfect order.

Meanwhile, Vincent had inquired throughout the neighboring vales about bird lime, a sticky substance often used to capture birds, and in a few days we acquired a quantity. By this time I had spotted the resting twig of a magnificent specimen of the Streamer-tail at the foot of the hill. Smearing it with bird lime, I retreated to nearby shadows to watch results. In less than three minutes, the bird zoomed to the perch, alighted on the gum, and was mine. Gently, I pried his tiny toes out of the diabolically sticky stuff and wiped them clean with kerosene.

In the large holding cage, he buzzed about

gaily, but ignored the test tube feeders. On the hour I caught him in my hand, poked his bill into the liquid and watched him take in amazing quantities. The third day he got the idea and started drinking freely from the feeders in the cage.

I put out more bird lime, each day adding a fine specimen or two, until the cage whirled with the wings of twelve. Several were fully-matured males, several immature with only the beginnings of long tails and four were females.

"Hilton" joined them and, as we suspected, after a few days without his leash, began to fly as well as any.

* * *

BACK HOME in Miami with my prizes, I immediately made a fine cage with many perches, a plethora of feeders and ample flight space. The next evening I noticed numerous unexplained loose feathers on the bottom of the cage. The following morning, after filling the feeders, I quietly retreated to a corner and sat motionless until the birds forgot me.

Squabbling soon broke out, then sparring, then duels, and finally a real Donnybrook. The cage was awl with fury. These tiny sprites were

battling with the frenzy of little gladiators. Attackers zoomed at victims as they clung desperately to their perches. With jabbing bills and battering wings and clamoring *tzeek-tzeeks*, they forced the perchers backward until they hung almost upside down. When one was finally knocked off on his back, an aggressor dropped on him, alternately hammering and yanking out feathers. Then they rolled over, each jabbing the other.

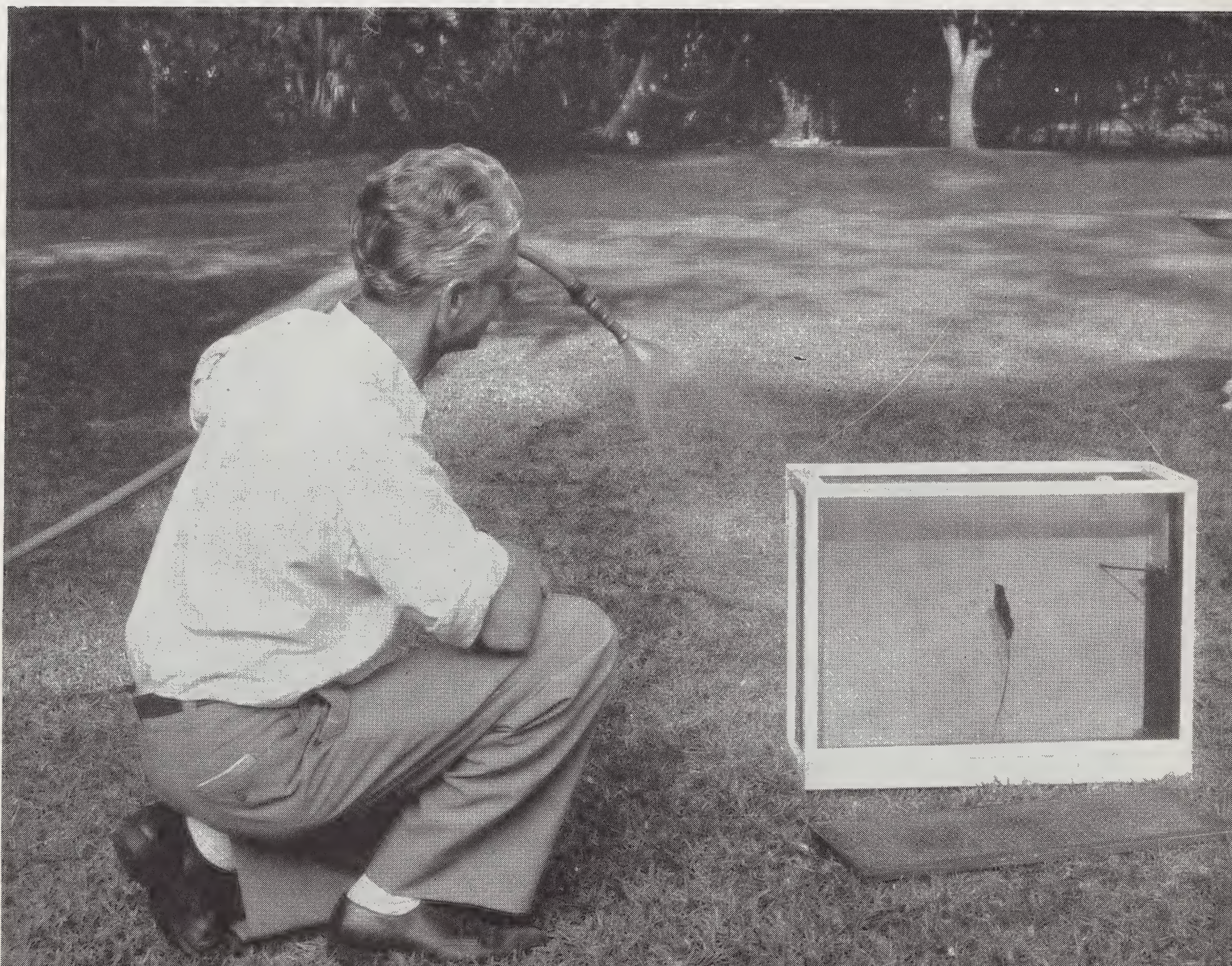
I stepped up to the cage. The ruckus stopped like magic. Instantly every bird was on his perch, calmly preening, and looking just like a little angel.

This was a major lesson for me. I recognized it for an outburst of the deep and strong instinct to protect feeding territory, a mighty and completely understandable force.

Thereafter, every hummingbird I have collected on ensuing expeditions has been given a private compartment with individual room service. No more dormitories or group dining halls.

A bath in fine spray was the height of delight for this Streamer-tail. The author is turning the hose on it. After the bath, the bird dried itself in the sun with much vigorous preening.

Photograph by Oliver Griswold



This recognition of their natural desire to protect their food domain has been basic to a considerable number of successes with numerous other rarer and more delicate species.

Unfortunately, the feathers that had been



This picture of "Celia, Jr." was taken on June 11 when the chick was 24 days old — strong, perky, and already quite well feathered.

Both photographs by Dudley Brumbach, Cleveland Plain Dealer

The first Streamer-tail hatched in America, at the Cleveland Zoo. Here the female has alighted on the nest preparatory to feeding.

pulled out in combat included all the long streamers. Some grew them back in two-and-a-half months. Others took three. This seems to be an over-long time, and perhaps the cooler winter weather of Miami or the diet was the cause.

The Streamer-tails have shown a notable hardiness in captivity, as well as producing new records in aviculture. Several I sent to England, which were reported to be the first seen there, attracted considerable notice, especially a pair reputed to be the first to hatch young in captivity. Captain R. S. de Quincy of Marden, Hereford, wrote me his pair hatched two chicks. But the chicks survived less than a month.

The Cleveland Zoo, Director Leonard J. Goss has written me, was so successfully able to pro-

vide diet, controlled temperature and nesting conditions that two sets of two eggs each were laid. The first set broke when the nest tumbled. But the second hatched.

That was May 18, 1959. One chick died in the nest June 3.

As to the survivor, Dr. Goss wrote me November 6: "I can report that the Streamer-tail chick is still thriving. It is a female."

He went on to say that she is named "Celia, Jr.," after Mrs. Lee S. Crandall, wife of the General Curator Emeritus of the New York Zoological Park, and I was most complimented to be referred to as "Celia, Jr.'s" godfather. ("Celia, Jr." was still flourishing when ANIMAL KINGDOM went to press in late January.)

In the wild, the Streamer-tails had consistently revealed characteristics that led me to believe they would do well in captivity. Sometimes on woodland trails, from nowhere, a Streamer-tail would appear to hover before my face, helicoptering backward as I walked along, keeping constantly just a few feet ahead, while he inspected the visage under the hat brim. This appeared to be, not belligerency, but merely impelling curiosity, coupled with complete self-confidence. Several times I made quick moves with my hands, as if to catch him. Always, he just darted backward, barely out of range.

I noted, too, that all hummingbirds seen in the wild were always either on the wing or perched on small twigs. The twigs were usually bare. If they alighted on a leaf-bearing twig, almost invariably the perching space was bare on either side of them for the full length of the wing. Although their alighting and taking off was too quick for my eye, I surmised that this selection of an open space was because they used their wings as brakes to land or to rise directly from the perches. Possibly no coasting in or springing off. But this might be debatable.

However, I never saw a hummingbird alight on the ground or any other flat surface.

It has been said by some observers that they cannot walk or hop or run. But you should see them run sidewise on a perch in a cage! To check this, I have shifted a feeder from one side of a cage to another, when a bird was anxious to feed, just to watch the lightning speed of the tiny sidewise steps. I daresay it is probably true that hummingbirds cannot walk or hop forward or backward as so many other birds do, but their sidewise locomotion is agile and speedy. The foot motion is so fast they appear to glide from one side of the perch to the other.

To me, one of the most astonishing discoveries was the males' manner of preening the two long tail feathers. I had early learned their fondness for bathing.

They greatly enjoyed the fine mist of a garden hose gently sprayed into the cages. How they fluffed and rollicked!

After shaking the excess drops from his retrices, the bird would twist his tail feathers sidewise and forward to bring them closer to his feet. Then while balancing on one foot, he reached

back with the other, grasped the streamer with his toes, pulled it forward in a curve, and ran it through his bill to smooth out the wet barbs. It made one think of a wringer or a clothes mangle.

In this way, he could preen approximately the farther half of each long feather. Then, for final drying, he would vibrate the streamers so fast that, to the eye, it appeared he had about a dozen tails.

At this stage, his bright green breast had turned red, for as the emerald sheen became wet, it turned to ruby. The bronzy-green on the back became flecked with red. Then gradually, as the feathers dried, the ruby disappeared and the green returned.

Intrigued by this phenomenon, I sought the explanation in books, to learn that pigments are by no means the total answer to the hues of birds, but that in the feathers layers of refractive cells sort the rays of light and, like prisms, account for many of the color glories that delight the human eye.

But most surprising was the discovery that the male of this allegedly songless species definitely sings. Some might say that it depends on how liberally one interprets the meaning of the verb to sing. I would say it might also depend on what the bird, himself, feels he is doing.

This pouring forth of sound usually took place in the morning. Hunching down against the perch, with occipital crest spread out on either side of the head in charming display, he burst into vigorous runs and trills. Although barely qualifying as music to the human ear, these were obviously a magnificent rendition in the opinion of the Streamer-tail. What jubilation!

To me, even if they didn't have complete melodic accuracy, they certainly seemed to have the full intent and purpose of song. It was clearly a gay heart in a healthy body bubbling over in all-out exuberance.

Since the first expedition to Jamaica, we have made many others to Caribbean and Latin American countries, each with its delights with the hummingbird family. We have collected some larger species and many smaller, but to the Streamer-tails I am especially indebted.

They were the first to show me that in the small creatures of nature are many of her great surprises.

The Curious Feeding Habits of the Java Wart Snake

By HERNDON G. DOWLING

Associate Curator of Reptiles

“**T**OSS THEM A COUPLE OF ORANGES,” was the facetious advice offered by one of my herpetological colleagues when I inquired about the food habits of captive Java Wart Snakes. A pair of these unusual animals (*Acrochordus javanicus* Hornstedt) was on its way to the Zoological Park, and I had hoped to lay in a supply of their favorite food before they arrived. The reference to oranges concerned a report by Annandale in 1905 that, among other curious features and habits, these snakes were said to feed on “soft fruits.” This interesting bit of “information” was religiously copied in the scientific literature for several decades, and only recently fell into disrepute when the evidence had become overwhelming that all snakes, be they ten inches or ten yards in length, feed on other animals.

The actual feeding habits of the Java Wart Snakes are, as it happens, just as curious as Annandale’s report — but entirely different.

Two species of Wart Snakes inhabit the slow-moving rivers of southeastern Asia, and extend from India all the way through the East Indies to Australia — which means that they must be able to cross areas of open sea. They are so different from other snakes of the family Colubridae as to have been placed in a separate subfamily of their own, Acrochordinae. Ours are representatives of the larger species (*A. javanicus*), and are chocolate-brown above with a lateral light stripe or series of blotches, and are uniform cream-colored below. Neither species is often seen in American zoos, because of their distant habitat and the fact that they usually refuse all food and eventually starve to death.

Curator Charles Shaw of the San Diego Zoo had maintained one of these snakes for a record time of three years and ten months — on a weekly

force-feeding of sardines. Other zoos had done not nearly so well, and our supplier assured us that we, too, would have to push fish down their throats, by hand.

Wart Snakes are not handsome at best and on land one looks like nothing so much as a worn-out, wrinkled and underinflated fire hose. The best known photographs (taken at the Zoological Park many years ago), depict an individual on the floor and held in the hand, and show quite well the folds of loose granular skin. Out of the water the snakes seem awkward and sluggish, and appear to be almost helpless. They do not try to move very much, and what little movement they make is extremely slow.

Close examination of the snakes when they arrived showed the body and head to be covered with small, granular, heavily-keeled scales. Their eyes were small and dull, and the nostrils “top-side,” as would be expected in a specialized aquatic animal. The usual large head plates — and even the normal broad transverse ventral plates — were completely absent. The loss of such useful structures as ventral plates would seem to be disadvantageous to the snake, but it has made the fortune of many an East Indian hunter. These hunters sell thousands of *Acrochordus* skins every year, for the absence of ventral plates means that the skin is uniform for its entire circumference, and thus makes nearly twice as much useful leather for its size as would that of a more ordinary snake. Reaching a reported length of nine feet — with a good deal of extra loose skin, and with small scales — these snakes are tops for “reptile skin” leather goods.

Nevertheless, the usefulness of such loose and undifferentiated skin to the animal itself is not immediately apparent. In fact, I have never seen any suggestion that the skin might serve a prac-



Even in the water, the Java Wart Snake seems limp as it crawls slowly about the floor of its tank. Right: The extremely loose skin and the eyes at the top of head are characteristic.

tical purpose. As soon as our new acquisitions were released in one of the large (4 ft. by 4 ft.) aquaria in the Reptile House, however, it became obvious that the skin was more utilitarian than would be supposed from a dry-land view. Muscles under the skin in the rear half of the body compressed it neatly into as good an oar as a sea-snake might pride itself on. With this modified structure the snakes actively swam about in the water, showing little similarity to the sluggish creatures that they were on land. Although the tiny eyes continued to look dull, the tongue became active and proved to be another surprise. Light yellowish and slender, it was proportionately the longest and most deeply forked tongue that we had seen on a snake. With this remarkable organ the snakes inspected every corner of their new quarters, and finally settled down on the bottom, tucking themselves partly under a large rock. Here they again became their usual lethargic selves. The only movements were a slow and deliberate raising of heads to the water surface for a breath of air.

As we had been warned, the Wart Snakes seemed completely disinterested in the frozen smelt that make up the main diet of our other watersnakes. Force-feeding was considered but



discarded, for the record demonstrates that rarely is a reptile helped by force-feeding, and most of them live longer while starving than they do under the rough handling necessary in force-feeding. What is more, we have had extraordinary luck in having our animals feed themselves when given a sufficient variety of choices. One

Anaconda (*Eunectes murinus* Linnaeus), captured by Dr. James A. Oliver in Trinidad, waited for a full year before beginning to feed. It has now been with us for almost four years and recently gave birth to 14 young.

After offering smelt, unsuccessfully, for a couple of weeks I stopped at a bait store on the way to the Zoo and bought a dozen live minnows. When released in the aquarium they elicited the same response — complete disinterest. The next morning, though, eight of them were gone! The others disappeared the following nights. It was the same at the next feeding: apparent disinterest while we were watching, but a great deal of interest, and actual feeding, when no one was around.

The feeding was something we *had* to see. I could find no record of the feeding habits of these snakes, and they would surely be interesting. We waited several days beyond the weekly feeding date and then introduced some minnows early one morning before the public had begun to arrive. A wave of the long tongue and slow movement of one of the snakes toward the school of fishes showed immediate interest. As a minnow swam close there was a sudden sidewise snap that surprised us all — including the minnow, which disappeared down the snake's gullet amid a shower of scales. We had had no idea that *Acrochordus* could move that fast. There must be a good set of body muscles under that loose skin! The real surprise, though, was yet to come.

After a couple of fishes had been captured by this sidewise snap technique (which is also used by North American watersnakes of the genus *Natrix*), the minnows became wary and swam to the far corner of the aquarium. The Wart Snake gave up its active pursuit and seemed to be resting, lying on the bottom with its body arranged in a series of loose S-shaped loops. After a while the minnows became calmer and began to seek hiding places near the bottom. One of them swam into one of the open loops and tried to push under. A sudden movement of the body and the loop was no longer open! The small fish was completely enveloped in that loose, gritty skin and in a few moments the snake's head came back to pick up the now-motionless prey.

We watched the snake "fish" successfully several more times. It merely lay in its S-looped po-

sition until a fish squeezed into one of the open coils or otherwise made contact with its body. If the fish bumped into the body hard enough to be felt, the snake reacted instantly by throwing coils about that section of its body. However, if the fish swam into a loop gently, the snake did not seem to realize it, at first. Presently its head was brought over the loops from the anterior end back. When the head came opposite the loop where the fish rested, the sensitive tongue, or perhaps the nostrils, relayed the information "Fish!" to that part of the body, and the loops contracted and made the capture. If the fish did any amount of struggling, additional coils were thrown around it, sometimes to the extent that the entire body of the snake was arranged in a ball, with the fish hidden somewhere towards its center. Only when the fish bumped, as it were accidentally, while swimming by, did the Wart Snake miss its prey.

Acrochordus is a constrictor, then; a fish-constrictor, if you will. The utility of the loose, small-scaled, sandpaper-like skin becomes obvious when its fish-trapping technique is observed. Even a large fish with such a flat and sandpapery band wrapped around it would have a difficult time escaping. It is interesting to consider that one of the morphological features that some of the more specialized members of the venomous sea-snakes (Family Elapidae, Subfamily Hydrophiinae) have developed is small, rough (in some, actually toothed) body scales. Whether these snakes, also, constrict their prey seems to be unknown.

We still do not know whether we were just lucky in getting the one snake in a thousand (or the two snakes, for we are not sure whether both our specimens are feeding) that would feed in captivity, or whether any Wart Snake, given deep water at 80° F., fishes of appropriate types, and time, would do so. Obviously, the bait minnows available to us are smaller than their usual prey. The snake often takes a seemingly long time to discover a small fish in its coils after it is captured. We hope that our success, and the observations gained thereby, will lead others to experiment and see whether their *Acrochordus*, too, will feed voluntarily. If they do, these interesting snakes may become much more common in zoological collections.

ZOO NEWS IN PICTURES

Photographs by
SAM DUNTON



Two months old (when this photograph was made on December 17) and growing fast! The **OKAPI** baby gave the whole Bronx Zoo staff a fright at the end of December when it was seen to be limping and apparently unable to put weight on its right front leg. X-ray examination failed to disclose a fracture or a chipped bone, and it was supposed that the baby injured itself by slipping. The injury — or bruise — is disappearing and everything seems to be all right.

The **BAY COLOBUS** (*Colobus badius*) of the Belgian Congo is a rare monkey — in fact, this is the first one ever exhibited in the United States. Like so many African rarities, it came to us from Charles Cordier, one of the world's great animal collectors. Most Colobus monkeys are black-and-white; this one is brown. Oddly, for a monkey, it likes fish, although the bulk of its food is fruits and vegetables. Heavily infested with parasites when it arrived, it is still undergoing treatment in the Animal Hospital but should be on exhibition this spring.



CAPE HUNTING DOG puppies are not the most appealing puppies imaginable — but anyway they are more attractive than their parents! These four are the survivors of a litter of six, and the first born in the Zoological Park in 17 years. Cape Hunting Dogs are notoriously nervous and high-strung and, if excited, may kill their offspring. The male of our pair is extremely solicitous and at the time of birth actually helped the female to clean and care for the puppies. He had been excluded from the female's compartment before the birth, but she became so excited that he was allowed to stay with her. Both parents are highly protective of the pups, even against their keeper.





When an instructor in the training school of the Chinese Nationalist Army wrote some time ago and said he had a **FORMOSAN GIANT FLYING SQUIRREL** as a pet — and did we want to buy it? — we jumped at the chance. For this is a very large, rare and beautiful squirrel and we had never before exhibited it. In fact, almost nothing is known of its habits in the wild. Presumably they are much like those of our own, but much smaller, Flying Squirrels. The animal is quite tame and readily allows itself to be picked up and spread to show its “wings.” On the back it is reddish-brown; white on the head and below. So far, it is eating mostly fruits. Its scientific name is *Petaurista alborufus lena*. The mainland form of this squirrel attains a length of 40 inches, somewhat larger than ours.



The baby **TIGER** is named “Fini” and that’s what we think she is — Dacca’s 32nd and presumably last cub in her long and productive career. Fini was born on November 14 and for the first time Dacca showed no interest in her offspring. Consequently little Fini (a female) was taken away from her immediately and turned over to Mrs. Helen Martini to rear. For the time being she is in the Martini home, but she will be big enough to return to the Zoo soon.

Shark Attack

But this time man is
doing the attacking—
through a panel of scientists

By JAMES W. ATZ

Associate Curator, New York Aquarium

OF MAN'S NATURAL ENEMIES, only the shark and the serpent still exact from him a full measure of primeval fear. When man was a naked, unarmed savage, he was preyed upon by many animals; today it is he who has become the Nemesis of all wildlife. Animal gods and Leopard Men now govern the lives of a bare handful of jungle folk, but all over the world, even the most sophisticated of city dwellers, if they imagine themselves in contact with the wild, continue to dread sharks and snakes, often to the extent that the mere mention of their names elicits feelings of apprehension and revulsion. Moreover, as far as sharks are concerned, that dread is growing. More and more people are becoming aware of the sea — as a place for sport and play, as the principal source of man's future wealth, and as the home of original wonders and high adventure. Inevitably they are acutely aware of the shark as a menace, as one of the very few animals given to unprovoked attacks on man.

There is not the slightest doubt that sharks can be man-killers. In fact, when the overwhelming evidence is considered, it is hard to realize that not many years ago some scientists sincerely believed that sharks rarely if ever attacked human beings. Sharks, however, cannot in any way be considered a major threat to mankind. The malarial mosquito, for example, kills more people in a single year than the shark has dispatched in all time. Since 1919 about one hundred shark attacks have been recorded in Australia, which of all countries with adequate records is the one that has suffered the most from sharks. Dr. V. M. Copleson, who carefully studied these incidents as well as other unusual causes of death in Australia, has put the shark in a proper perspective:

"The idea that the sea is full of savage sharks swimming around seeking what humans they may devour has little to support it. In fact, death by shark bite, while grotesquely spectacular, is an uncommon cause of death in Australia. The risk is less than walking across a road or playing cricket or football. More people are killed by snakes, bulls and spiders than by sharks, three times as many are struck by lightning, and many more are killed by horses."¹

All of which makes most people's fear of sharks appear a bit morbid. Nor can the suddenness and savagery of the onslaught, the hideous wounds and high mortality, even the inscrutable nature of the attacker itself, quite explain why people feel as strongly about sharks as they do.

Strangely enough, the very intensity of this irrational fear is likely to be responsible for the increase in knowledge that may eventually dispel the emotion. When people feel *very* strongly about something, sooner or later something has to be done about it. This is exactly what the U. S. Navy discovered during World War II when it began to send men on long flights over lonely, shark-infested oceans. Facing the enemy was one thing; fear of being forced down in such waters was quite another. To meet this problem of morale, the Navy developed the "Shark Chaser," a small cake of chemicals repugnant to sharks, so prepared that they dissolved slowly when exposed to sea water. As soon as a downed flyer, floating in his "Mae West" life preserver, spotted a shark, he removed the cake from its waterproof envelope and dangled it in the water by means of a tape. The Shark Chaser was considered a success, both psychologically and operationally, but in recent years the desire to improve it has grown and with this the realization of the need to know exactly why sharks attack

¹ "Shark Attack." Angus & Robertson, London and Sydney. 1959.

men in the first place. Obviously a program of scientific study was required, and the Office of Naval Research turned to the American Institute of Biological Sciences for help. In April, 1958, 34 experts from the United States, Australia, South Africa and Japan met at Tulane University where they discussed shark attacks and their prevention. The need to organize existing knowledge about sharks quickly became apparent. As a result, the experts are now preparing a book to do just that. In order to stimulate and direct new studies, they formed the A.I.B.S. Shark Research Panel. This committee is now supervising a worldwide program of research whose aim is a better understanding of the behavior and biology of sharks which in turn may lead to the solution of the shark problem.

Chairman of the Panel is Dr. Perry W. Gilbert, Professor of Zoology at Cornell University, and his office serves as one of its headquarters. A brief visit there quickly reveals how varied is the Panel's approach to the study of shark attack and how all sorts of seemingly unrelated facts are being fitted into one coherent picture. Part of the ample room forms a laboratory; here a technician is preparing slides of shark eyes so that their finest structure may be described with the use of a microscope. Near her stands a large cabinet filled with carefully labeled sharks' teeth and pieces of shark skin. In less than 5 per cent. of the cases of attack has the culprit been identified. This is understandable when it is realized that 29 different species of shark have been placed either in the category "Known to be Dangerous" or "Potentially Dangerous" and that several of these are wide-ranging in habit. The victim or witness of a shark attack is not likely to notice the fine points of structure or coloration that characterize different kinds of sharks. Some species have uniquely shaped teeth, which occasionally break off in the wound — a grisly calling card. In such instances, the collection of shark teeth provides a simple and accurate key. Someday we may be able to identify sharks by the kinds of wounds they inflict. To this end, an ever-growing collection of sharks' jaws and photographs of wounds inflicted by sharks is being assembled by Prof. Gilbert.

Lining the walls are shelf upon shelf of books and papers devoted to some aspect of the shark —

the work of biologists, medical men and various non-professionals who preceded present-day investigators and on whose shoulders they figuratively stand. An important part of the Panel's activities is centered in the large green metal filing cabinet that stands by itself near Prof. Gilbert's desk. Here are kept the records on every shark attack known to the Panel. A second set, elaborately cross-indexed, is maintained by the Panel's Secretary, Dr. Leonard P. Schultz, in the Division of Fishes of the U. S. National Museum. As soon as Drs. Gilbert or Schultz learn of an attack, they communicate with a scientist in the area, no matter how remote, who then gathers all the information he can about it. They have the help of a printed questionnaire which calls for such detailed data as the color of the victim's clothing and the clarity of the water in which the attack occurred. Multiple documentation is sought whenever possible so that accounts may be checked against one another. Newspapermen and the attending physician often contribute significant details. All this is assembled in its own individual folder along with newspaper clippings and photographs. Later, official documents, such as a coroner's report, may be added. There are 39 folders on file for the year 1959, originating from such widely scattered localities as Tasmania, Mozambique, the Solomon Islands, Panama, the Philippines, Florida and California. Twenty-five of them are identified by white finding-tabs, which indicate that the victim recovered, but the rest are marked with red. In these fourteen instances, the individual died.

Sometime in the future, when the green filing cabinet is much fuller than it is now, an analysis of the carefully documented attacks may reveal some as-yet hidden regular patterns or correlations. Then we may be able to predict with confidence under what conditions shark attacks are most likely to occur — and so avoid them. Up to now, the single most impressive feature of the attacks on men by sharks has been their *unpredictability*. Men have floated in the sea for hours while sharks circled them, even nosed and touched them, but did them no harm. On the other hand, attacks have occurred under the most unusual and different conditions in places where no attack had ever been reported before. Commandante Jacques-Yves Cousteau, who has prob-



This 15-foot White or Man-eater Shark, *Carcharodon carcharias*, became entangled in a net off the coast of southern California in the spring of 1958. It weighed slightly more than 3,000 pounds, and the largest of its characteristically triangulate teeth were more than two inches long. The White Shark is generally acknowledged the most dangerous of sharks.

Photograph by Karl W. Kenyon

ably had more underwater experience with sharks than any other man, declared that "The better we are acquainted with sharks, the less we know them, and one can never tell what a shark is going to do."

A few generalizations can be made, however — as Panel Member Stewart Springer has done, for example. Seldom will a shark bite a man in water that is cooler than 65° F. This seems to explain the seasonal pattern of shark attacks occurring around Australia, on the southeast coast of Africa and along our own Atlantic seaboard. That the presence of blood or other body exudates attracts sharks and puts them in a feeding mood everyone will agree. This was dramatically confirmed five years ago by a diver who, while moving along the bottom near shore in California, was suddenly struck on the head by a Leopard Shark, a small species not known to attack man and so poorly armed that it did not inflict any injury. The diver then noticed that his nose had been bleeding and that blood had been passing into the water. After snapping at some blood-tainted exhaust bubbles, the shark turned and again struck at the diver's head. This time it was warded off and swam away. Similarly, spearfishermen are learning that any dead fish they tie to their belts often makes them the center of attraction for

sharks that ordinarily would pay them no heed.

Once a shark attack has occurred, the chances of several more taking place in the same area are relatively high. This statistic, plus the frequent history of no attacks in a given area for many years, then several attacks within a period of a few weeks to a few years followed by another long period of freedom from attack, led Coppleson to propose his "rogue shark" theory. A single, particularly aggressive shark or one that had acquired the habit of feeding on human beings, could account for these patterns nicely, and in a couple of instances a "rogue" appears to have been caught, whereupon the assaults ceased. Man-eating lions and tigers immediately come to mind, but there is no evidence that man-eating sharks give up feeding on other kinds of prey as the big cats frequently do once they have killed and eaten a man or two. The classic example of a "rogue" shark was the eight-and-a-half-foot White or Man-eater Shark that terrorized the New Jersey coast in the summer of 1916. Within a ten-day period it killed four men or boys and mutilated another boy. Two days later a shark was caught not far away, and in its stomach were found human flesh and bones. No more attacks occurred after this. More recently New York has had two or three "shark scares," but no in-

juries that were unequivocally shark-inflicted have been suffered by bathers in the metropolitan area since 1916.

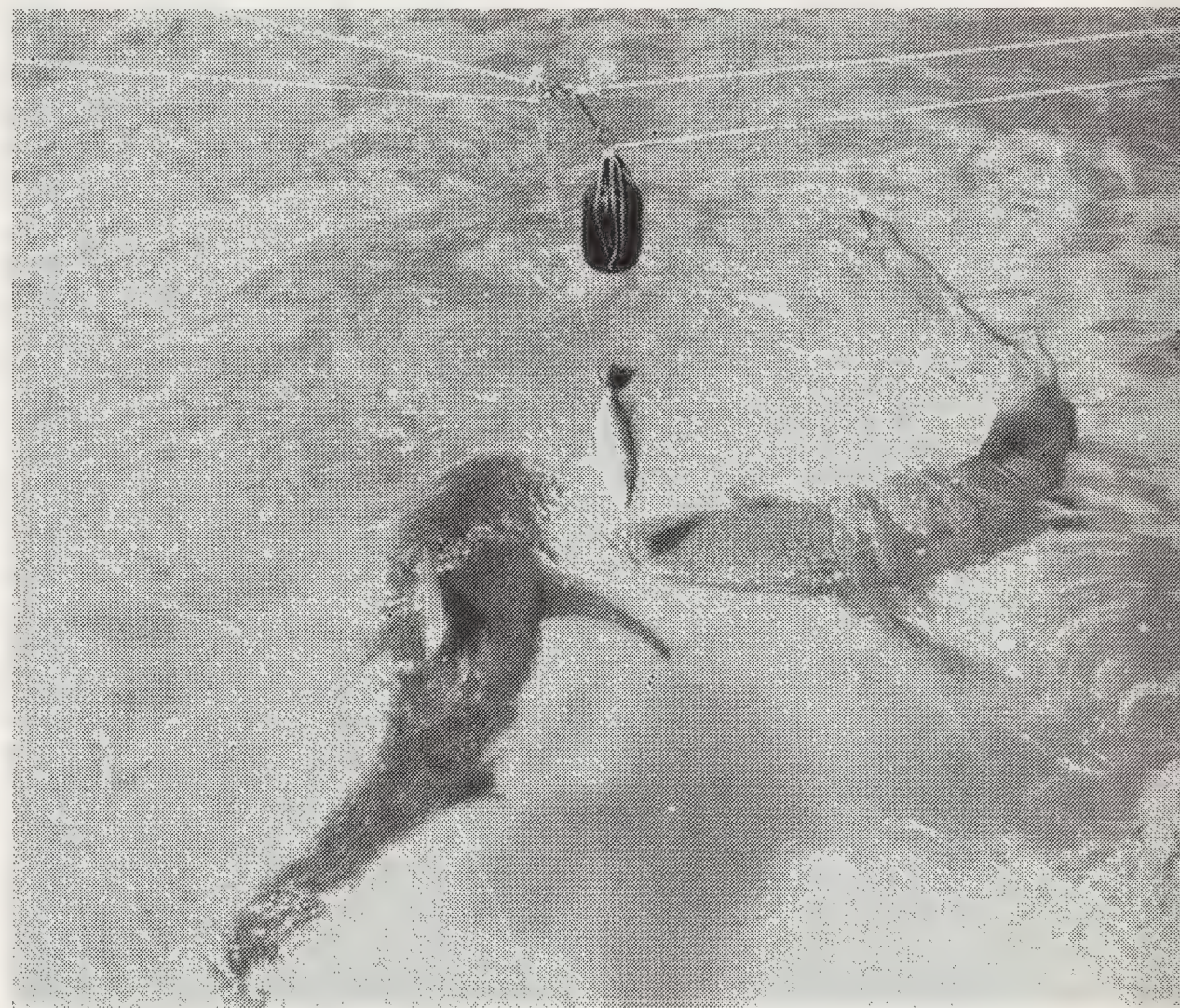
One of the New Jersey attacks was unique in that the shark's fourth victim was killed while trying to rescue its third, who was being held in his arms at the time.

This appears to be the only instance in which a would-be rescuer has been attacked by the shark responsible for the original disaster. Incredible, yet fully documented, stories have been told of how sharks have returned to attack their human prey again and again but have not harmed swimmers who were trying to save the injured bather, although they were close enough to have been bathed by his blood. In one case, the shark was able to slip among five men who were trying to pass an inflated rubber tube around its victim, and administered still another bite. In another instance, the shark actually pulled its unfortunate victim out of the arms of a friend who was trying to save him.

Several similar cases are on record, and they all indicate that the shark can accurately locate its prey even amid situations of great confusion. They also show the shark as singularly intent on its prey, even in the presence of other vulnerable examples of the same species. This behavior is strikingly different from the "mad dog" feeding behavior exhibited by schools of bluefish, tuna

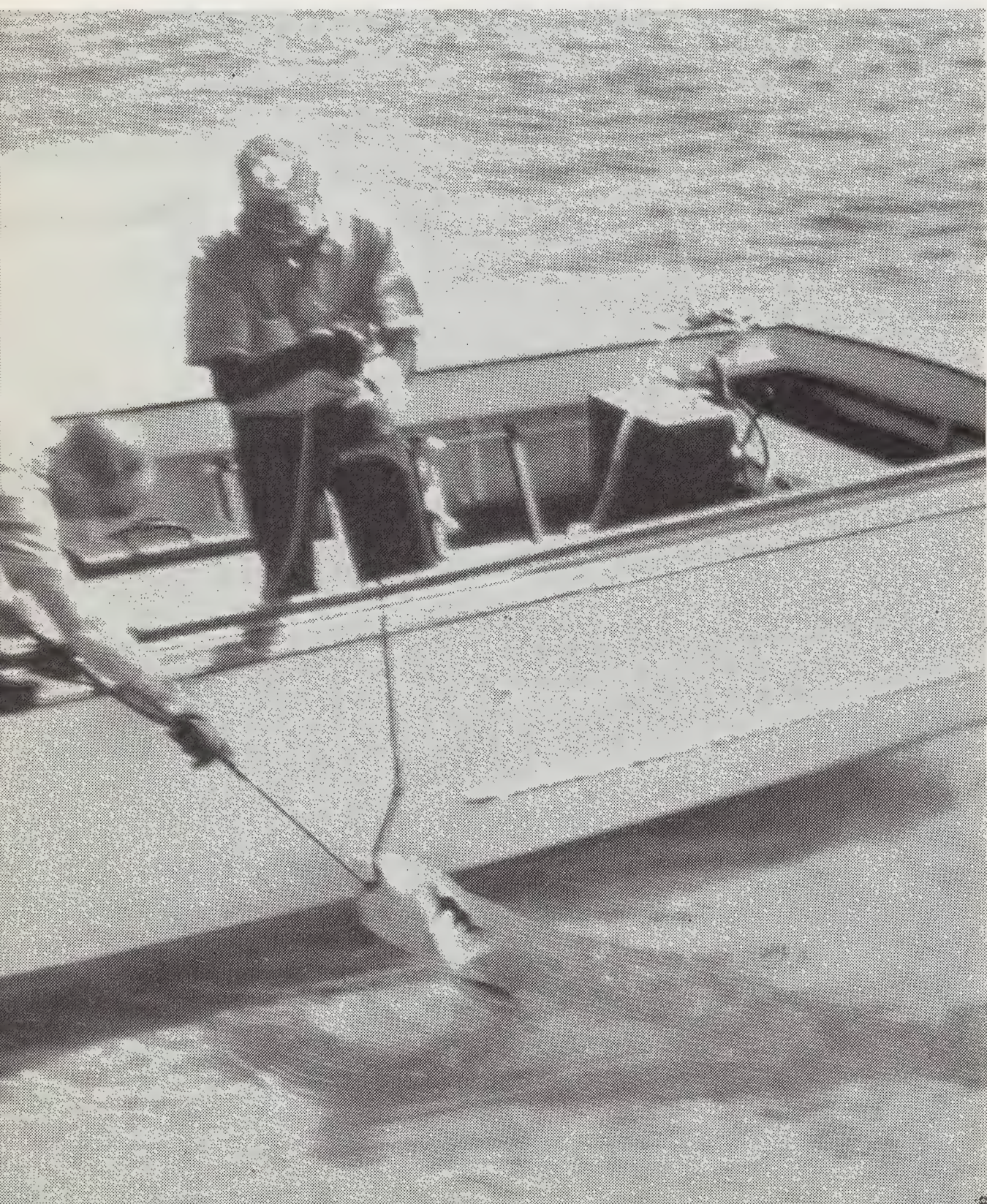
or piranhas, or by groups of sharks in which each individual wildly and rapidly snaps at almost everything that crosses its path. Evidently sharks in groups act differently from sharks alone.

There are times, at least, when some sharks show no discrimination whatsoever in their feeding habits. The list of things that have been found in sharks' stomachs is long and bizarre and includes just about everything, edible or inedible, that occurs in the upper levels of the ocean. Fishes eaten include seemingly well-protected species like the armored Trunkfish, the pin-cushion Porcupine Fish and the stingray, which sometimes leaves its sharp bony "sting" embedded in the shark's mouth. Sharks eat other sharks, even smaller members of their own species. Some sharks specialize in shellfish; most of them relish



In the special shark pen at the Lerner Marine Laboratory, a Bull and a Lemon Shark approach the dead fish lure above which is a bottle of nigrosine dye, which is to be tested as a repellent.

Photograph by Perry W. Gilbert



Subduing a nine-and-a-half foot Lemon Shark by means of rapid anesthetic forced into the mouth and over the sensitive gills with a garden spray. The shark is then easily put in a holding pen.



squid and octopus if they can get them. Turtles are consumed shell and all, and sea birds, sealions, seals and even whales are not immune to occasional attack. Sharks are strictly meat-eaters, and since no one has ever accused a shark of being fastidious, the presence of horses' hooves and other offal, as well as a corpse now and then, is to be expected. But how to explain the mouldy bread, decayed oranges, tin cans, oil-soaked cotton waste from ships' engine rooms, and sacks of coal that have been removed from various sharks' stomachs? Behavior that permits the swallowing of such a miscellany seems poles apart from that of a man-eater boring in for his particular prey.

We really know very little about the feeding behavior of sharks — except that they don't have to turn on their backs or sides to bite, as popular belief would have it. As a matter of fact, we know surprisingly little about all aspects of shark behavior, and the underlying physiology as well. This is a situation that the A.I.B.S. Shark Panel has set out to change. Without a good understanding of shark behavior we cannot hope to know what makes certain sharks attack men and what we can do to eliminate this tendency.

An obvious first step is to study the sense organs of the shark. This reasonably well accomplished, we shall have a rudimentary idea of what a shark's world is like — to a shark. We do know

Dr. Perry W. Gilbert (center) prepares to operate on a Nurse Shark, *Ginglymostoma cirratum*. Although considered one of the most inoffensive sharks, the Nurse Shark is known to bite under some conditions.

that sharks are primarily smell-minded. General observations, the anatomy of the brain, and a few controlled experiments all agree that smell is the most important faculty by which the shark finds out what is going on in its environment. Practically nothing has been determined about the sensitivity of shark noses and not a great deal more about what specific chemicals are attracting or repelling to a hungry shark. Research along these lines is fundamental to any improvement of the Navy's "Shark Chaser." It is being actively pursued on several fronts.

In order to study the behavior patterns and responses of large sharks, including dangerous species, special pens have been built in the shallow, clear waters at the Lerner Marine Laboratory on Bimini. These pens are unique, since they include an operating chamber into which a large shark may be guided, there to be secured in a net and lifted out of the water by an overhead crane. Prof. Gilbert designed these facilities to enable him to administer an anesthetic to a shark, then temporarily blind it or block its sense of smell. To operate successfully on a shark in

this manner is no mean accomplishment when one is dealing with a thrashing 800-pound monster, which could amputate a man's arm or send him flying through the air with ease. In another pen, the reactions of sharks, either normal or operated-upon, can be observed and recorded by means of a motion picture camera. The present tests are being made with chemicals, foods and physiological fluids such as blood to find out which are attractive, which repellent under different conditions. One group of substances that is being tested are those formed during the rotting of shark flesh. A good many years ago, whalers noticed that when they killed sharks and allowed them to remain in the water to decompose, no sharks would be seen for long periods afterwards. More systematic observation has confirmed this effect on at least some species of sharks, although not for all. But it would not be practical to carry a piece of rotten shark meat around in order to keep the sharks away! Therefore a patient search is being made to discover which of the hundreds of decomposition products are the active agents. Many other materials also require testing, for example, the "ink" that the octopus releases when disturbed. When Moray Eels, which regularly prey on the octopus, are exposed to this pigmented fluid, they will not bite an octopus even if they accidentally bump it with their snout.

Some people may give off substances — in their sweat, for example — that make them especially attractive to sharks. Or they may *lack* a repulsive substance present in most people. Prof. Gilbert suggests that some day swimmers, divers or pilots may be able to take a pill that makes them malodorous to sharks.

There are even greater gaps in our knowledge of the vision of sharks. At one time sharks' eyes were believed to be of little use to them, but Prof. Gilbert's anatomical and behavioral studies indicate their eyes are very sensitive, although incapable of acute vision. This would explain the attraction that light or shiny objects frequently have for sharks, and why some dark-skinned natives hide the soles of their feet with black sandals before going in the water and Greek sponge divers hide the palms of their hands in the armpits of their black suits. Possibly this may be why a shark attacked only the hands of a man who recently spent 18 hours in the Atlantic, clinging

to a life-preserver cushion from his sunken fishing skiff. The myths that sharks rarely if ever attack dark-skinned people or that they cannot see any dark object may have originated in the attractiveness that light or bright things have for them.

Other senses must be considered also. Why will sharks gather from considerable distances around a source of weak, spasmodic motions in water, but not strong rhythmic ones? On occasion divers have been able to drive away sharks by shouting at them underwater, but some sounds definitely attract them. The whole subject of the effects of underwater sounds and vibrations on sharks needs to be investigated.

The need to analyze the feeding behavior of sharks has already been pointed out. Reproduction may require some attention, too, because the possibility exists that a waxing and waning of aggressiveness may be associated with hormones and the reproductive cycle. Experiments recently conducted at the Cape Haze Marine Laboratory on the Gulf coast of Florida have showed that sharks are capable of learning in a simple fashion. Does learning play any role in the development of an habitual man-eater or "rogue" shark?

The Shark Panel of the A.I.B.S. is primarily concerned with a single, rather unusual type of behavior that occurs in less than 10% of all the species of sharks. Nevertheless, in trying to find out what causes sharks to attack men and how this can be prevented, the Panel has had to go far afield. Harmless as well as dangerous species have been studied, and fishes other than sharks have provided clues pointing to profitable lines of research. We have also seen that there is much more involved in a thoroughgoing analysis of attack behavior than the study of the attacks themselves. In fact, the Shark Panel is interested in every aspect of the biology of sharks, because no one knows just where some piece of information vital to the solution of the central problem will turn up.

The more we learn about sharks, the less mysterious they must become. We hope eventually to be able to predict and control their behavior to such an extent that shark attacks will become a thing of the past. Nevertheless, we are sure that the sinister essence of the shark will linger in the minds of men long after it has ceased to be the cause of sudden, unpredictable death.

A Forest View of Kinkajous

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

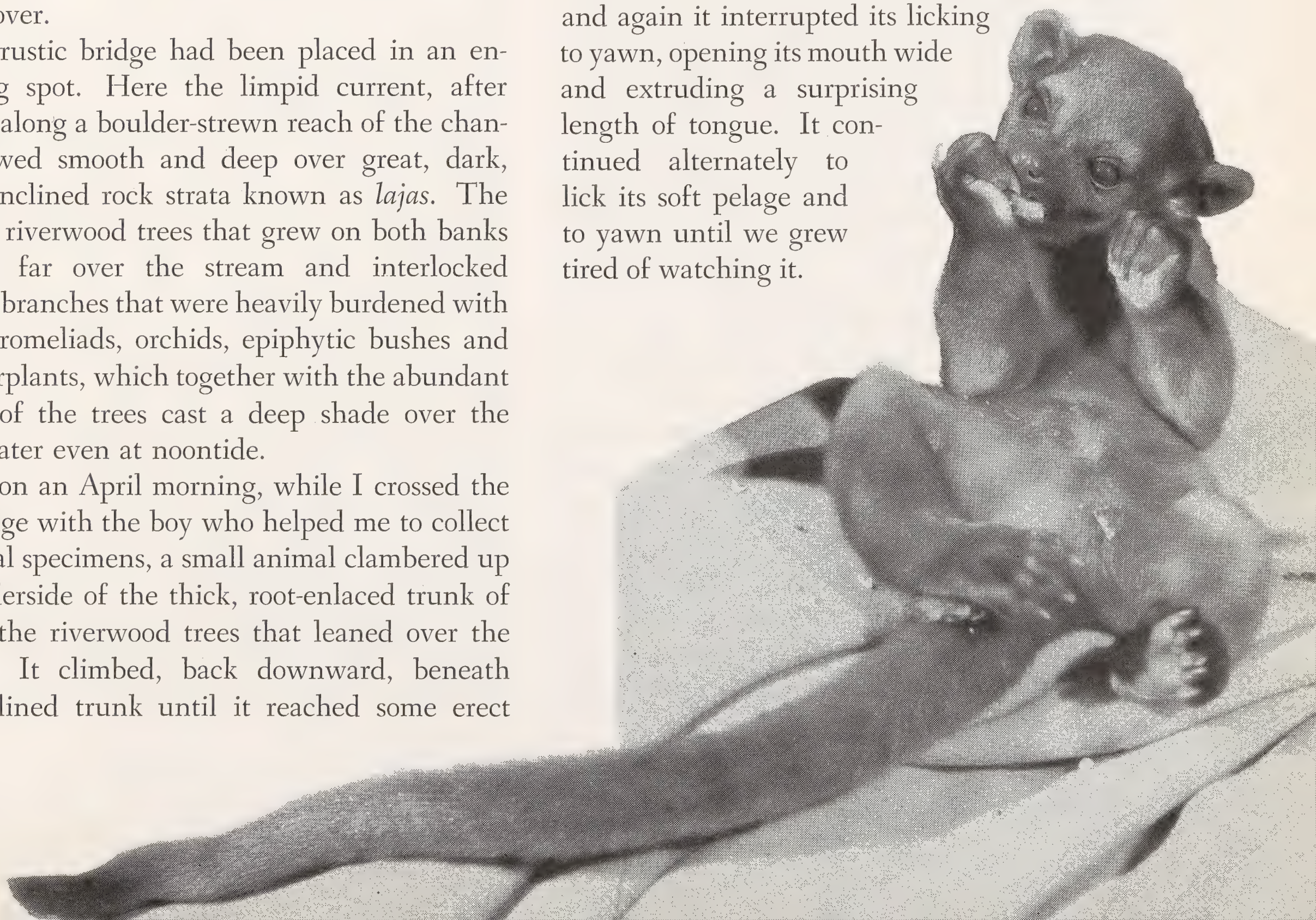
TWENTY YEARS AGO I settled down for a season's work in a cabin near the head of the Térraba Valley in southern Costa Rica. The tiny rustic dwelling, walled with rough, unpainted boards and roofed with red tiles, stood on a hillside close by a clearing that was still littered with the charred remains of the great trees of the rain-forest. To reach the unpaved road that led to the distant village, it was necessary to pass two broad streams which flowed through the pastures in front of the house. The larger of these rivers, the Pacuar, could be crossed with dry feet only on horseback at the ford. The smaller stream, the San Antonio, whose tree-lined course was closest to the cabin, could in the dry season, when the water was low, be traversed by jumping from stone to stone. There was also a footbridge, a slender log slightly flattened on top, adequate for the barefooted, although one who wore shoes preferred to steady himself with a long pole as he passed over.

This rustic bridge had been placed in an enchanting spot. Here the limpid current, after purling along a boulder-strewn reach of the channel, flowed smooth and deep over great, dark, gently inclined rock strata known as *lajas*. The massive riverwood trees that grew on both banks reached far over the stream and interlocked gnarled branches that were heavily burdened with ferns, bromeliads, orchids, epiphytic bushes and other airplants, which together with the abundant foliage of the trees cast a deep shade over the quiet water even at noontide.

Late on an April morning, while I crossed the footbridge with the boy who helped me to collect botanical specimens, a small animal clambered up the underside of the thick, root-enlaced trunk of one of the riverwood trees that leaned over the stream. It climbed, back downward, beneath the inclined trunk until it reached some erect

branches, up which it easily scrambled into the foliage where it stopped and gave us an excellent view of itself. About as large as a raccoon or a tayra, but more slender than the former, it was nearly everywhere clothed with brownish-gray fur that appeared thick and soft. Despite its low, flattened crown, the animal had an attractive little face, with a short, blunt, black muzzle, large dark eyes and small rounded ears set far down on the sides of the head and expressively mobile. Its legs were short, and each foot had five toes and a prominent bare sole. There was a graceful curve near the end of its long tail. I took it to be a Kinkajou, but never before had I enjoyed such a good view of one.

Paying little attention to the two onlookers not far below it, the Kinkajou settled down comfortably amid the branches and began to wash its limbs with its tongue, which was remarkably long and slender. It seemed very sleepy, for again and again it interrupted its licking to yawn, opening its mouth wide and extruding a surprising length of tongue. It continued alternately to lick its soft pelage and to yawn until we grew tired of watching it.



All the warm afternoon, the Kinkajou drowsed above the river in the epiphyte-laden boughs of the riverwood tree. Soon after lunch I found it lying supine in a crotch, its arms thrown over the branches for support, its head bent forward and resting on its upturned abdomen. Later in the afternoon it changed its position, resting now with its hindquarters on a thick horizontal bough, its foreparts curled forward, and its head between its upturned legs. When aroused by a noise, it yawned sleepily and soon resumed its slumbers.

Returning again an hour after nightfall, I found the Kinkajou moving off through the top of the riverwood tree. When it glanced down at me, its eyes gleamed like bright stars in the beam of my electric torch. Soon it went off through the dusky foliage where I could not follow. It seemed an attractive creature and I wished to learn more about its ways. But like many of the mammals of the tropical forest, it went about its business under cover of darkness and was even more difficult to study than the elusive birds that flitted through the high treetops.

I have never seen a Kinkajou hunting in the daytime, as the nocturnal opossum sometimes does. Even to find a Kinkajou licking itself and drowsing in an exposed position is unusual, for these mammals prefer to hide away in holes in trees while the sun is in the sky. It has long been my habit, as I pass through the woods, to tap on trunks containing holes, for at times something of interest is thereby discovered. In this way I have found the nests of woodpeckers, trogons, toucans, ant-thrushes, and other birds, and less frequently a mammal has come forth at my summons. Not long ago, my hammering brought from the dead top of a small living tree a Woolly Opossum with three or more little ones, as big as mice, clinging to her nipples, their pink tails curled up like tendrils. I recall at least three occasions when I found Kinkajous passing the day in holes high up in dead or dying trees.

One of these Kinkajous took possession of a hole thirty feet up in a massive dead trunk in the midst of the forest, which when first found by me was the dormitory of a male Pale-billed Woodpecker. It was doubtless the powerful chisel-beak of this largest of the Central American woodpeckers that had carved the wide round doorway and the deep chamber to which it gave access. For at

least two months the woodpecker lodged here alone, and in the evening or at daybreak I often saw his high-crested, bright red head framed in the neatly rounded opening. After he abandoned this hole, probably to sleep in a new one that he had prepared for himself, his mate used it for a while as her nightly lodging.

After the female woodpecker ceased to sleep in this cavity, it remained for several months without a tenant and I lost interest in it. But one day as I passed by, I noticed a twig with some brown dead leaves protruding from the hole. When I clapped my hands, the sleepy little face of a Kinkajou appeared in the doorway and looked inquiringly down at me. I tried to make the animal come out and give me a better view of itself, but no amount of noise, nor hammering and scraping on its trunk, would drive it from its snug bedroom. When it had seen enough of the obstreperous biped far below, it backed down into its dark retreat and stayed out of sight. I continued on my way, leaving it to round out its day

Not as young as the baby Kinkajou the author saw being carried by its mother, this is the youngest we have had in the collection. It is less than a year old, slow-moving but a fearless and restless climber.

— or should I say “night”? — in peace. I am not sure whether the leafy twig had been carried into the hole by the Kinkajou or some other animal, possibly a squirrel. But I am certain that the woodpecker was not responsible for this addition to its former dormitory.

Early on a sunny morning in May I went into our small coffee plantation to cut some garden stakes from branches that had been pruned from the coffee bushes. My machete struck ringingly against the hard wood. After I had cut a few stakes, I heard a shrill note, like the call of the Sulphur-bellied Flycatcher, a bird which I have not seen on this farm. Looking up, I espied a small animal climbing a tall, blasted trunk that stood at the edge of the plantation, at the brink of a high precipice that rose above a rocky watercourse. In the side of the stub was a long, narrow opening that led into a central hollow, and at the top grew a slender, upright sprout.

The animal was a Kinkajou, and in her mouth she held a baby the size of a squirrel. She



ascended the trunk to the top, then continued up the slender sprout, which appeared hardly stout enough to bear her weight. Reaching beyond this, she grasped the end of a branch of one of the trees that shaded the coffee bushes. Although the twig that she held was not much thicker than a lead pencil, the Kinkajou carefully climbed across to it with the baby dangling from her mouth, much as a Howling Monkey might have done. Scrambling up to a thicker part of the bough, she paused to survey her situation. The clean-limbed Inga tree offered her neither cavity nor concealment, and it stood isolated, so that she could not have reached another tree without first descending to the ground. Doubtless recognizing her error, after a minute's pause she carefully returned to the top of the stub where I first saw her. As she hesitated here, evidently perplexed, I hurried back to the house for my binoculars. I returned just in time to see her climb head first down the trunk and enter the opening in its side.

After the Kinkajou had disappeared in the hollow trunk, I resumed my task of cutting stakes. But before I could cut another, she emerged from the cavity with her baby still in her mouth and started up the trunk again. I stood quietly watching; and after ascending a few yards she paused, looked around, then returned to the cavity. Whenever I chopped loudly, she came out; when I stopped making a noise, she went back to her retreat. I decided to postpone my work and leave her in peace.

As the Kinkajou climbed, she kept the end of her long tail resting lightly over any convenient branch, with a half turn at its end to prevent its slipping off. This seemed to be done merely as a precaution, as I did not see her support herself with her tail. She held her baby with its neck in her mouth. When she climbed downward head first, the little one's body dangled limply, its four pink paws waving feebly in the air. As she passed over an obstructing branch, the baby seemed a great impediment, and she dragged it

clumsily over the obstacle. But whenever she found a crotch where she could support herself adequately with her hind legs, she used both arms to fold the infant against her breast like a human mother. The cub's long tail had a half turn at its end like its dam's.

For the next ten days, the Kinkajou and her baby continued to live in the hollow stub at the edge of the precipice beside the plantation. Becoming accustomed to the noise of chopping, she merely looked from her doorway when I wielded my machete among the coffee bushes. I could also make her reveal herself by clapping my hands. Then her puckish face peered out from the dimly lighted hollow, and often she stuck forth her long tongue, yawning or licking something. I did not again hear the shrill note, like that of the Sulphur-bellied Flycatcher, which first drew my attention to her.

About this time an urgent matter took me to the distant city. As I returned to the farm after an absence of several days, I heard voices and loud noises coming from the coffee plantation. Suspecting trouble, I dropped my bag in the path and hurried into the grove, to find a group of men and dogs in front of the Kinkajou's hole. They had driven the mother into the top of the neighboring shade tree, where she climbed along a slender branch with her baby dangling from her mouth. One of the men was aiming a gun at her. My timely shout saved her. My caretaker, fearing that the Kinkajou would catch his chickens, had called in these neighbors to kill her while I was away. I explained that in the daytime, when the chickens are abroad, the Kinkajou is inactive, while at night, when the Kinkajou hunts, the chickens roost in a tree equipped with a metal band which prevents small animals from climbing up the trunk. Hence it is unlikely that a Kinkajou ever catches a properly attended chicken.

After I had sent the men off with a scolding, the Kinkajou passed over to the trunk where she slept by day and climbed rapidly downward. But instead of returning to her hole as I expected, when halfway down the stub she took a great leap, passing over the creek and landing in the far lower boughs of the trees on the opposite shore. It was a bold and hazardous jump that would have won admiration for the most agile

monkey. From the boughs overhanging the channel, she passed into the adjoining second-growth thicket and soon vanished. I could not see whether she still carried her cub, but doubtless she did.

A few days later, I was delighted to find that, despite her narrow escape, my Kinkajou had returned to her old home. When I clapped my hands in front of the doorway, the youngster now looked out on its own and made little peeping, bird-like noises. One evening I watched for the mother and her cub to sally forth for the night. Before going to my observation post among the coffee bushes, I made a noise to assure myself that they were still at home. Peering out of the narrow opening to see what was happening, the mother yawned repeatedly, sticking her slender tongue several inches beyond her widely opened mouth. The sun had not yet set; it was far too early to arise; and she was still very sleepy! After I stepped behind a coffee bush, she disappeared into the bottom of her hole. I watched until it grew dark without seeing her emerge. Before leaving, I threw the flashlight's beam against the opening, where it picked out two brightly gleaming eyes. Evidently, after her long day's fast, the Kinkajou went late to hunt for breakfast.

After the end of June, I found only a young Kinkajou in the hollow tree at the edge of the coffee plantation. If this was indeed the baby that I first saw in its mother's mouth on May 23, it had grown rapidly. Had the mother voluntarily relinquished the cavity to her offspring and found another for herself, or had some mishap befallen her? I know too little of the Kinkajou's habits to hazard an answer to this question. Difficult as it is to work out the life histories of the birds of the tropical forest, to obtain similar information about the mammals is still harder. Many of them are nocturnal; many rear their families in deep hollows of various sorts rather than in accessible nests; and since they depend on scent no less than sight to warn them of danger, the observer cannot so easily conceal himself from them as in the case of birds, for studying which blinds are profitably used. It is only by piecing together scraps of information that we glean slowly over the years that we begin to understand the manner of life of some of these animals.

CONSERVATION

Wallace D. Bowman

Wallace Deal Bowman, new assistant director of research for the Conservation Foundation, graduated from Washington University in 1949 with an A.B. in Zoology but it was not until he received his M.S. degree in 1953 that he formally entered the resource field. At that time he served as research assistant in the Cooperative Wildlife Laboratory at Southern Illinois University and undertook graduate work in wildlife management. The following year he entered Paul Sears' Conservation Program at Yale University where he surveyed the use being made of Connecticut's coastal marshes as his thesis topic. In 1956 he was awarded an M.S. degree in Conservation by Yale. After serving a year as agricultural research assistant with the United Fruit Company in Honduras, Mr. Bowman undertook doctoral studies at the School of Natural Resources at the University of Michigan. In 1958-59, while serving as assistant planner with the Washtenaw County Planning Commission at Ann Arbor, Michigan, he was also appointed executive secretary of an Intergovernmental Committee for directing water management studies in the Huron River Basin.

As modest (no picture, please) as he is prolific, Wallace Bowman is now deeply involved in the administration of the February conference of the Technical Advisory Committee on Area Resources Development, is collaborating with Roger Hale on a Small Woodlands Study and has accepted an invitation from Paul Sears to conduct a series of classes and seminars for the Yale Conservation Program.

Outgrowth of CF Pesticide Conference

The effects of chemical pesticides on wildlife populations are to be reviewed by a new special committee of the National Research Council, which is a welcome sign that pesticide use is beginning to be looked at in a reasonable and critical fashion.

When DDT first came into wide use, an admirable pattern of cooperation developed whereby

FOUNDATION

wildlife specialists and economic entomologists interested in insect control collaborated in extensive field studies of the effects of DDT on insects, birds, mammals and fish. Unhappily the same pattern of collaborative research has not been followed with the many new and even more toxic chemicals that have come into use since 1945. Thus while a reasonable satisfaction is felt regarding the effects of pesticides on human health, many authorities have pointed out that the long-term effects of pesticides on wildlife, water resources, plants and soils are not known — and should be. The National Research Council committee will review all aspects of pesticide and wildlife relationships and will undoubtedly make specific suggestions for the many further investigations that are plainly needed. The committee will consist of representatives of the pesticide manufacturing industries, wildlife interests, government agencies with pesticide programs and other experts. The Conservation Foundation was represented by Stephen Bergen at the initial meeting of the Council on January 15.

Briefly Noted

Paul Sears has agreed to write opening and closing chapters of the Crop Yield Study which will be published by the Conservation Foundation sometime in 1960 . . . Wallace Bowman, recently returned from the AAAS meeting in Chicago December 26-31, reports an increasing amount of time allotted in symposiums and papers to the problem of "population explosion" . . . Richard A. Cooley, our Alaskan Research representative, flew East in January to confer with the Outdoor Recreation Resources Review Commission in Washington on a proposed study to identify Alaska's recreation potentials . . . George Treichel leaves on March 15 for Brussels where he will assume the post of Staff Ecologist with the International Union for Conservation of Nature and National Resources.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

President Osborn Making Survey of African Wildlife Situation

President Osborn left on January 17 by air for London, preliminary to making a two and a half months' survey of the wildlife situation in eastern and central Africa. He was accompanied by Mrs. Osborn.

In London he will spend a week in preparatory talks with government officials and wildlife and conservation experts before flying to Nairobi to begin a thorough tour on Kenya, Uganda, Tanganyika and the Belgian Congo.

The general purpose of the trip is to give the Zoological Society and the Conservation Foundation a clearer understanding of the wildlife crisis in Africa, and the means by which American aid can be most effectively employed.

Dr. and Mrs. Osborn will return to New York at the end of March.

Department of Tropical Research Makes a "Micro-safari"

"Expeditions set forth from zoological parks and museums in search of elephants, armed with huge nets, powerful guns and tranquilizers," Dr. William Beebe writes from the Department of Tropical Research Laboratory in Trinidad. "In strong contrast are the micro-safaris which leave Simla provided only with hand nets, glass vials, binoculars and a preknowledge of the habits of their prey, which is the egg of a butterfly.

"For example, one day just before Christmas Henry Fleming and our field assistant, Sonny Ram Lal, were sneaking through heavy brush in the jungle of Surinam. Their quarry was the rare orange and black butterfly, but their hope was not to net it and ultimately pin it in a box, but to follow on its trail as one would that of an elephant. This was in the hope that, if in the proper mood and not startled, the butterfly might lead them to the unknown food plant needed by her young, and even, just possibly, lay an egg.

She did both in the present case and we added still another species to the round dozen we could study at Simla."

Curl-crested Aracari Toucan —a Great Bird Rarity

Early in January the Bird Department received a specimen of the Curl-crested Aracari Toucan (*Pteroglossus beauharnaesii*), one of the few ever exhibited alive — if, indeed, it has been exhibited anywhere.

All toucans are striking because of their large beaks, but the Curl-crested has the added attraction of a large patch of glossy-black curls on the top of its head. Its wings are dark olive green, its back dark red, and its breast yellow with a band of red.

Very little is known about its habits in the forests of eastern Peru, western Brazil and northern Bolivia, although it is said to travel in small parties.

Our specimen is on exhibition in the Jewel Room and is well worth a special visit.

IN BRIEF

White-bearded Gnu Again. Near the end of the year the antelope collection received an interesting addition, a male White-bearded Gnu. We had exhibited the animal only once before; a pair was received in 1903 and the last one died in 1917.

Hooded Mergansers. On July 8, 1909, the Zoological Park purchased its first Hooded Merganser, a female, for \$1.00. The bird died two days later and there had been no more specimens of this beautiful little fish-eating duck until November 14 last, when two were acquired from Charles A. Pilling of Seattle. Mr. Pilling several years ago managed to establish the species from eggs taken in the wild and ours were the 67th and 68th he has reared.

President Fairfield Osborn receives the Medal of the City of New York. Left to right: Mrs. Peter Grimm, Mrs. Shirley Osborn Ayres, Laurance S. Rockefeller, Mayor Wagner, Dr. Osborn, Mrs. Rockefeller, Mrs. Osborn, Mr. Grimm, Commissioner Richard C. Patterson, Jr. The presentation ceremony took place in the Reception Room at City Hall Jan. 11.



Sandford Paints New Bird. An illustration in color, by Lloyd Sandford, the Zoological Park's artist, is the frontispiece of the December issue of *The Wilson Bulletin*, publication of the Wilson Ornithological Society. It depicts *Rallus mirificus*, a new Rail, described in an accompanying article by Kenneth C. Parkes and Dean Amadon.

Those Questions! The need for such a service as Question House, through which our Education Department answers the public's zoological questions, is continually being demonstrated. Here are some of the recent queries — made in all seriousness:

"Who invented animals?"

"Are rabbits and kangaroos closely related? They should be, for they both jump."

"Do elephants change color?"

"What is the most poisonous animal in the world?"

"Do lion cubs have blue eyes at birth?"

"Do snakes get sleeping sickness in winter, and can people catch it?"

Dr. Osborn Receives Medal of City of New York

The Medal of the City of New York was conferred on Dr. Fairfield Osborn on January 11 in recognition of his twenty years as President of the New York Zoological Society. The presentation was made at City Hall by Mayor Wagner.

He described Dr. Osborn as "a truly outstanding man of our time who has devoted his ex-

traordinary gifts to the public interest." In his very brief speech of acknowledgment, Dr. Osborn remarked that "It is so illogical to receive a medal for something one so greatly enjoys!"

The medallion was inscribed: "Presented to Fairfield Osborn, Imaginative Friend of Our Earth's Resources, by Robert F. Wagner, Mayor of the City of New York, January 11, 1960."

In an editorial entitled "A Deserved Honor," the *New York Times* commented upon the ceremony.

PUBLICATIONS OF INTEREST

NO ROOM IN THE ARK. By Alan Moorehead. 227 pp., map, many illus. in color and black-and-white. Harper & Bros., New York, 1959. \$5.00.

Alan Moorehead is a percipient traveler; a reporter who knows how to elicit the interesting and revealing story — and a very good writer indeed. His account of the animals and people in southern and eastern Africa is uncommonly urbane (much of it appeared in *The New Yorker* some months ago), but no less an ardent argument for wild life for all that. As for protection of "what is left of the wild life in Africa," he believes that "For the moment this is a losing battle." Nevertheless, he adds that "I never met a game warden in Africa, or anyone connected with the national parks, who was in the job for any other reason than that he loved the work and believed in it; and this perhaps more than anything else leads one to hope that they will not be defeated in the end." — W. B.

BIRDS OF ALASKA. By Ira N. Gabrielson and Frederick C. Lincoln. 922 pp., 10 colored plates by E. R. Kalmbach and O. J. Murie. The Stackpole Co., Harrisburg, Penn., and the Wildlife Management Institute, Washington, D. C. 1959. \$15.00.

This is the first comprehensive Alaskan bird book and it presents a thorough review of 321 species represented by 414 races. From the literature, from previously un-

published Fish and Wildlife Service data and from their own extensive personal experience, the authors have constructed an excellent synthesis of what is known of the great bird fauna of the least studied but largest state. Introductory chapters on interesting aspects of Alaskan bird life, on migration, ecology and on introduced, but so far unsuccessful, game birds supplement the species accounts which comprise the body of the book. Species accounts include description, general range, range in Alaska and haunts and habits. The very detailed Alaskan range material is an especially valuable contribution.

Alaska is caught up in a "last frontier" spirit of steam-rolling development; a sort of spirit which has disregarded wildlife values in the past. Gabrielson and Lincoln have not only provided a basis for the study of the new state's teeming and relatively unknown avifauna, but also a foundation for wildlife students in the conservation battles that are sure to face our last major unspoiled wilderness. — W. G. CONWAY.

ELEMENTS OF MATHEMATICAL BIOLOGY. By Alfred J. Lotka. xxx + 465 pp., 72 figs. Dover Press, New York, 1958. \$2.45.

This classic work first appeared in 1925, but Lotka's

quantitative approach to evolution and ecology, as well as his penetrative ideas, are still pertinent today. Now that the book is once more generally available, I am sure that at least a few young biologists are going to get the exhilarating feeling, akin to revelation, that I did when I first read it years ago. — J. W. ARZ.

DEMON OF THE NORTH. By Peter Krott. 40 illus. from photographs, in black-and-white, 2 maps. Alfred A. Knopf, New York, 1959. 260 pp. \$5.00.

Originally published in Swedish and later in English, under the title Tupu-Tupu-Tupu, this engaging book now makes its appearance in a first American printing. It has to do, basically, with the author's experiences in hand-rearing baby wolverines collected in the wilds of Finland. The resulting observations of their behavior, both as house pets and later, after partial reversion to the wild, reveals much of the natural history of these much feared but little known animals. Interspersed are notes of various other creatures, including reindeer, European moose or elk, lynx, swans, cranes and others. The theme is one of adventure, as well as of animal lore, so that it is not only informative but entertaining as well. — L. S. CRANDALL.

New Members of the New York Zoological Society

Between November 1 and December 31, 1959

Life

Mrs. Alfred Ely
Charles Agustis Griswold
George Lande

Supporting

Mrs. H. K. Corning
Mrs. Seaton Gales

Contributing

Mrs. George S. Amory
Mrs. Fjord Burchell
Edward C. Childs
David C. Clark
William Porter Davisson
Thornton Delehanty
Dr. Robert E. Eckardt
Mrs. Ulrich J. Franzen
Mrs. S. Freudenberg
Mrs. W. French Githens
Mrs. Carl Gram, Jr.
J. A. W. Iglehart
Mrs. Irwin Kramer
Mrs. Selma R. Leff
C. H. Leonard
Thomas E. Lovejoy, III
John Lowry
Mrs. Alexander T. MacNutt
Harry P. McIntyre
Waldo McCutcheon McKee
Martin Mayer
Ernest M. Milch
Mrs. Jean Model
Mrs. Robert Montgomery

Dr. Leon Morgenstern
Dr. Robert S. Mumford
Dr. Frank H. Peters
George R. Puckhafer
Mrs. David R. Raynolds
Dr. David H. Schonholz
Robert E. Scofield
Mrs. Lore Steinitz
Walter Steuer
John F. Thompson, Jr.
Mrs. Elise S. Untermeyer
Dyer S. Wadsworth
Dr. Jesse Werner
Mrs. Douglas Williams

Annual

Mrs. Sidney Bacharach
Fred Baker
Dr. Lowyd Ballantyne
Mrs. Theone Bannert
Mrs. Robert E. Blum
Mrs. Helen E. Cobert
Alden S. Condict
Dr. John F. Devlin
Dr. Wilbur Gershenson
Justin M. Golenbock
Hy Goode
Alexander Guest
John Howe Hall, Jr.
John J. Halpin
Dr. Lester Hollander
Mrs. Melvin N. Jennings
Phillip Kaplan
Hermann Kessler
Mrs. Pauline Klasfeld

Ralph E. Krueger
Mrs. Albert P. Loening
John Maisel
Dr. M. J. Markham
Mrs. Woodie Marsh
Edward K. Mosenthal
Mrs. Craven Nichols
Grover O'Neil
Mrs. Samuel M. Page
Malcolm C. Peyton
Alvin V. Roberts
Mrs. Philip F. Rosmarin
Peter M. Rowe
Miss E. Cranford Salter
Mrs. Earl C. Sandmeyer
Nicholas Schaffner
Guenter Schubert
Mrs. Mary Scully
Mrs. Pauline F. Siwek
Mrs. Jarvis James Slade
Mrs. Roger Stevens
Mike Stoller
Miss Janet Stone
Dr. Wm. Duncan Strong
Milton Tabachnick
M. Daniel Tatkon
Paul H. Terry
H. Graves Terwilliger
Saul J. Turell
Mrs. Eugene Warner
Henry Ramsay Warner
Charles G. Witherspoon
Paul Yakovenko
Richard Scott Ziegler
Mrs. Howard Zucker

The Waldorf Meeting

It was warming and encouraging to see so many Members at the recent meeting at the Waldorf-Astoria. One impression we collected was that many friends also attended, which leads us to theorize that

THE CHANCES ARE . . .

You brought a friend with you (a constructive thing to do)

The friend enjoyed the evening (just about everyone did)

The friend might like to be a Member (why not?)

THEREFORE . . .

Won't you send us the friend's name and address? We'll be glad to send informational material about the Society, a Membership application and a warm invitation to join us.

MEMBERSHIP COMMITTEE
New York Zoological Society
New York 60, N. Y.



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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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In the Tradition

THE HISTORY of our Society is highlighted by unusual accomplishments. Throughout the years many staff members have undertaken difficult assignments for the advancement of zoological knowledge or for the acquisition of rare species of animals to enrich the collections at the Zoological Park or the Aquarium.

Among the first "pioneers" was William Beebe, then Curator of Birds, who in 1910 and 1911 journeyed throughout Asia collecting material for his notable four-volume "Monograph of the Pheasants." Other remarkable expeditions followed in which Dr. Beebe with John Tee-Van as his chief field assistant established a jungle research station in British Guiana, explored the Galapagos Islands and the Sargasso Sea, later culminating such activities by the epic descent in the bathysphere into the ocean near Bermuda to establish a new world-record depth dive.

Numerous other exploits by staff members come to mind — Lee Crandall's journey to New Guinea in 1928 to collect Birds of Paradise, the wanderings of Charles H. Townsend (then Director of the Aquarium) to study the migrations of whales, Raymond Ditmars' trips to Central America to obtain rare reptiles such as the Bushmaster, John Tee-Van's long journey to the province of Szechuan in northern China to bring back the Giant Pandas, Myron Gordon's studies of platyfish and sword-tails in Central America, William Bridges' sortie to the Belgian Congo to facilitate "Operation Noah's Ark" in 1948 and more recently Jocelyn Crane's world travels in her studies of *Uca*, the ubiquitous Fiddler Crab, and Carleton Ray's flight last summer to islands in the Bering Sea to collect a Walrus for the new Aquarium.

Ranking with all of these is the mission to the upper reaches of the Andes just completed by William Conway, Curator of Birds, described in this issue. This expedition, carried out under forbidding conditions of altitude, weather and terrain, called for skill of the highest order and has resulted in the acquisition of a remarkable collection of birds never before exhibited in a Zoological Park. This success, so arduously won, is new evidence of the vital tradition that makes our Society what it is.

Fairfield Osborn

ABOUT THE COVER PICTURE

Not only rare — but appealingly friendly. That is the Woolly Spider Monkey (*Brachyteles arachnoides*) pictured on the cover. The honey-colored little animal came to us last year from a scientist working in southeastern Brazil, and it was apparently the first ever exhibited in this country. Now it lives happily with a Humboldt's Woolly Monkey (*Lagothrix*) and a Spider Monkey (*Ateles*) in one of the large compartments in the Monkey House.



To the High Andes for THE RAREST FLAMINGO

By **WILLIAM G. CONWAY**

Curator of Birds

Photographs by **BATES LITTLEHALES**

National Geographic Society

A COLD AND SALTY LAKE of blood-red water, hidden between volcanic peaks beyond 16,000-foot Andean passes — could this be the home of a flamingo? In New York it had seemed impossible, and yet, in this lake, though the salty mud freezes at night in midsummer, though great winds raise a tide three miles above

the Pacific, the rarest flamingos in the world are the commonest birds. And here, in the high, desolate puna of the Bolivian Andes, a New York Zoological Society expedition has just captured the first James's Flamingos ever brought out alive.

There are six species of flamingo in the world but only one — James's, *Phoenicoparrus jamesi* —



warrants the words rare, mysterious and elusive. Yet it has been known for 110 years. Why is it “rare, mysterious and elusive”?

Between 1850 and 1909 a few skins were collected in Chile, Bolivia and Argentina for natural history museums, but after 1909 the bird seems to have dropped out of sight. As recently as 1956 Robert Porter Allen published his great flamingo study in the Audubon Society Monograph series and there was little he could report that was definite about the James's — although there was much that stirred the imagination.

“The mystery that surrounds this strange, three-toed little highland flamingo today,” he wrote, “is matched by an equally obscure history that goes back more than a century . . . The most astonishing fact concerning *Phoenicoparrus jamesi* is that its habits and nidification have never been described. No actual breeding sites, past or present, are known . . . Although the fact that *jamesi* has not been observed for many years may be a result of its isolated range . . . we cannot but wonder if James's Flamingo still survives. At the moment this would seem to be one of the outstanding mysteries of the avian world.”

These words stimulated an expedition of Chilean ornithologists, Johnson, Behn and Millie, to search for *jamesi* in 1957. After a long and arduous search they discovered the James's Flamingo at an incredible red lake called Laguna Colorada in a relatively unknown area of the high Andes in Bolivia. Here, at an altitude of 14,800 feet, they identified small numbers of the long-missing bird among large flocks of the more common Andean and Chilean Flamingos, and managed to collect a skin. Later the same year the Chilean entomologist Luis Peña visited the red lake, collected further skins and discovered that *jamesi* was, in reality, by far the most abundant flamingo on Laguna Colorada. In 1958 the American ornithologist Roger Peterson, guided by Peña, became the first North American to see and photograph the James's Flamingo, and, incidentally, the first man to see all six forms of flamingo alive.

Looking south across Laguna Colorada high in the Bolivian Andes where our James's Flamingos were captured. The lake, which is extremely salty and colored blood red by algae in the water, has a width of about four miles and rests between towering volcanic peaks at an altitude of 14,800 feet. The arrow in the distance shows, behind a salt island, the location of the flamingo colony visited by the expedition. However, attempts to capture the birds by “cannon nets” were not successful, and eventually the party had to resort to the old device of simple snares, set where the second arrow points. In this barren land the most prominent features of the terrain, besides the volcanos, are outcroppings of lava and tufts of stipa grass, seen in the foreground.



Last summer, when Señor Peña undertook a whirlwind trip around the United States, Mr. Peterson brought him to the Bronx Zoo and with this visit as impetus we wrote Peña for suggestions about obtaining a small group of James's Flamingos for us. The surest way seemed to be an expedition starting from New York, and soon it was in the planning stage and Roger and Barbara Peterson invited me to visit them for the Thanksgiving holiday, for a "flamingo feast." We reviewed movies and hundreds of color slides that Roger had made during his Laguna Colorada expedition and dissected every problem of the forthcoming trip in a session that lasted until 2 o'clock in the morning. This briefing later proved invaluable. Roger lent me his waders, the same pair he had worn at Laguna Colorada, and I could hardly refrain from assuring him that now I would surely follow in his footsteps!

In January there was a last minute scramble for special equipment. The most troublesome item was a "cannon net trap," a large net (30×75 feet) that is pulled up and over a flock of birds by means of projectiles fired from three small cannons. Both Roger and Luis felt this was the surest way to capture the flamingos, and after reviewing Roger's pictures I could see no better method, so only five days before departure the trap was finally assembled from special parts made to order in four states. In the meantime, mist nets and spring traps had been put in readiness, 300 yards of special fishing line was purchased with which to tie snares, and arrangements were made with the *National Geographic Magazine* to send a photographer along on the trip. The expedition promised to be extremely difficult; we were bound for almost uninhabited country where severe weather would be normal and where we would have to do strenuous work in the thin atmosphere of nearly 15,000 feet. In the light of these conditions it was fortunate that the *National Geographic* chose one of its most rugged photographers, Bates Littlehales, for the assignment.

On January 20 Bates and I stepped out of a DC-7B into the bright dry warmth of Antofagasta, Chile, scarcely 25 miles south of the Tropic of Capricorn. Waiting for us at Customs was Luis (Lucho) Peña, whose youngish, quiet and thickly-spectacled appearance gave no sign that he is one of South America's toughest and most experienced

field naturalists. Within minutes we met two more important members of our expedition, a jeep and a very experienced-looking power wagon. The latter machine, actually a converted four-wheel-drive military ambulance with bunks that could be folded down for sleeping, contained a folding boat and a supply of camping equipment that gave us confidence in our ability to withstand the climate of the high mountains.

Early the following morning we met the remaining expedition members: Gerardo, Lucho's right-hand man and a superb field assistant, small, tough and wiry; Leopoldo, a newcomer to expedition work and invariably smiling no matter how difficult the situation (it would be less than proper to omit the fact that his upper central right incisor was prominently absent); and Jorge, an eighteen-year-old Chilean youth who some day is likely to be among the foremost Chilean naturalists. When introductions were completed, we began the long ascent into the Andes toward the town of Chuquicamata.

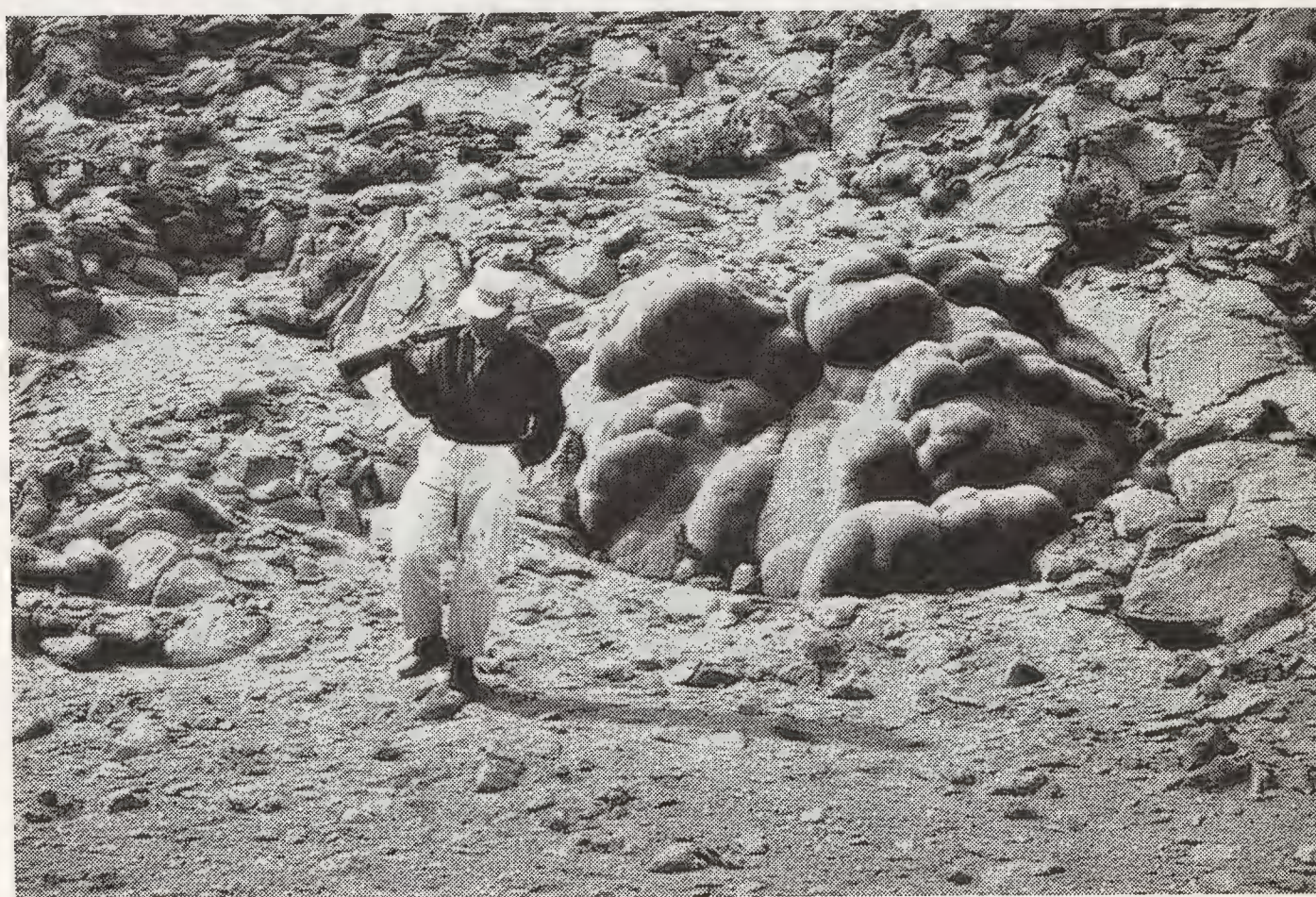
At "Chuqui" we parked outside the Chile Exploration Company and were soon ushered into the offices of General Manager Robert Becker, whose help we had requested from New York. He painted a picture of the situation we might expect in terms of weather, supplies and Indians during our trip into the hinterlands. Peterson and Peña had experienced serious Indian hostility at Laguna Colorada and Roger had been forced to leave the lake with his work uncompleted. Lucho made no secret of his apprehensions concerning another expedition to the same area and felt the situation might be a dangerous one for us. Groups of bandits worked through the area from time to time and if we met these people we could expect trouble and, most certainly, the loss of some of our more desirable supplies and equipment. However, we were now forewarned and the friendships which Chilex had created were there to smooth our way.

When we left Mr. Becker we found that practically every foreseeable event had been provided for. A man had been assigned to check and adjust our trucks for high altitude; a truck crew had been designated to guide us to the last stop along the frontier; extra gas and supplies were under way to our base camp at the Company's frontier house, Inacaliri; and, best of all, we were equip-



The snow-capped San Pedro Mountains of Chile dominate the high and arid puna country en route to the Laguna Colorada. This is a scene near the outpost of Inacaliri, the base camp of the expedition, where welcome supplies of food and extra gasoline were sent by Chile Exploration Company officials.

This strange green plant growing in the rocky soil of the puna is known as llareta and, when dried, is used as fuel in this part of the Andes. It appears to be soft, but actually it is extremely hard. The man is Mario Soza, a local diplomat who accompanied the party to insure friendship with the Indians.



ped with a local diplomat, Mario Soza, who had visited Laguna Colorada in the past and knew some of its local people. With the purchase of flamingo food pans and a number of sacks with which to pad such birds as we might catch, during rough travel, our preparations were complete.

Chilex provided a special luncheon for us at their guest house and here we met Chief Engineer Bob MacDonald, who brought us an invitation to a party at his own home that night. Later we were amazed when, at the delightful party, Lucho was presented with a fine Chilean cognac, for in some mysterious fashion our hosts had

learned that January 21 was his birthday. This was only a small sample of what was to come, however, for Chilex later sent truckloads of badly needed supplies to us, keeping tabs on our whereabouts and eventually making all of our airplane and export preparations for the return trip.

The next step was to Inacaliri and into the high puna. The puna is a desolate, treeless, pastoral zone of the high central Andes, and to us it seemed typified by widely scattered clumps of vegetation, either grasses or low bushes. Lucho's altimeter needle pointed between the 11,000- and 12,000-foot marks as we entered the puna.



climates and do support their own legends, dominated every vista, and, for that matter, blocked each way. The rock is brown and red, often black and often yellowish; the only relieving green to be seen is that of the deceptively pillow-like masses of a plant called *llareta*. It is dried and used for fuel throughout this part of the Andes.

Eventually, the needle of the altimeter, which had registered more than 16,000 feet during much of the trip, indicated our gradual descent and Mario pointed ahead to alert us for the first glimpse of Laguna Colorada. The red lake was a breathtaking sight: blood-red waters resting in an enormous sump between torpid snow-topped volcanos — not a mountain lake with green, pine-

A freshwater stream runs into the salt beds of Laguna Colorada at this point, and in the foreground provides moisture for low-growing forbs with uncomfortably sharp leaves rather like spruce needles. Llama herds fed on them.

At sunset the sky turned red to match the scarlet lake and a large flock of James's Flamingos waded through the shallow water for a late feed before retiring farther into the lake at night. In the background are banks of salt.

From Inacaliri we could see clouds and violent electrical storms hovering over the distant Laguna Colorada country, and rain turning to sleet plagued us briefly upon our arrival. We could not risk the 16,000-foot mountain passes until the weather cleared, but our enforced wait proved fortunate, for the morning following our arrival several of the crew found themselves victims of "puna sickness" with the splitting headaches and nausea induced by the altitude. The least effort added one severe nosebleed after another to Jorge's symptoms.

On January 27 the weather cleared and we departed, with a mixture of anticipation and apprehension, for Laguna Colorada. Would the Indians be at the lake, and would they be hostile? Would our little caravan be intercepted by bandits? And, would the weather force us back after we arrived at the lake? None of our fears materialized.

The trip led us over enormously high, pebbled plains, over desolate lava fields and past the dead, eroded hearts of old volcanos whose sides had worn away. Always the magnificent snow-capped Andean peaks, which seem to support their own

covered shores, blue waters and verdant sedges such as we usually imagine, but a wide, flat, glittering ruby of a lake in a violent setting of black lava, white salt and fire-born pebbles. Not one tree existed. Indeed, no vegetation save the sparse herd-like clumps of ubiquitous yellowish *stipa* grass and infrequent greener *tola* bushes could be seen. Later, when we neared the Laguna shore, we found high green grasses growing at several points where fresh spring waters found their way into the lake.

The lake was filled with flamingos, a sight so glorious that no restrained adjective will do. "Red water, red birds, snow-topped mountains!" Bates repeated; and, not only that, but three species of flamingos dwelling side by side. Only Lucho could be disappointed. His comment, "Very few flamingos." Later, we made numerous counts and completely encircled the lake to estimate the population. We even mounted a 35-power telescope on lakeside mountains so that we could see most of the lake from one point, and our counts lent weight to Lucho's first reaction, for when he was there with Peterson in 1958, he had seen approxi-



mately 8,000 birds. Evidently migration was now well under way, but we estimated that 4,000 were present during our visit.

The Indians were not in evidence, and, hoping for the best, we set about making camp. But no sooner had we begun to set up our tents than Laguna Colorado's principle adversity made itself felt — the intense, punctual and nerve-wracking wind. By the time we had placed the power wagon and the jeep to afford the best windbreak for the tents and completed making camp, Bates and Lucho had developed "puna throat," a dry sore throat often with a nagging cough. Notwithstanding the wind, we unpacked the cannon net and donned hip boots to trudge out nearly half a mile into the lake to a submerged mud bar where a large flock of flamingos had spent much of the afternoon. As the sun settled behind the mountains it grew colder and colder and we worked with aching fingers, absorbed in the tasks of carefully folding the net into position, loading and wiring the cannons, water-proofing them with polyethylene bags and stringing 500-foot cables to a nearby mudbank where I might lie in a blind

to fire the trap with the blasting machine. Gerardo punctuated our discomfort with the single word, "Sunset!" and we realized that we were in dark, inflamed waters under a cold carmine sky, completely enclosed by black silhouettes of volcanic peaks. We were some 20 feet higher than the Matterhorn and nearly 700 feet higher than Pike's Peak.

Early the next morning we waded out to check the trap before entering the blind to watch for flamingos. Two nasty shocks awaited us. First, the lake for perhaps a quarter to half a mile adjacent to the shore was covered with a thin layer of ice. While we knew only too well that it had been extremely cold during the night, we had assumed that the high salt content of the lake would prevent freezing; besides, the springs along the shore, though fresh water, were warm springs with a temperature that averaged above 70°F., yet only narrow channels leading from these springs out into the lake were clear of ice. Our second shock came when we had stamped our way through the ice to the cannon net. Where only one inch of water had rippled the previous



evening, we found six inches. The bases of the cannons were submerged, and even more appalling, the drop in water temperature had resulted in the precipitation of huge salt crystals all over the net. The trap had become so heavy that an attempt to fire it would have been disastrous. Thus we discovered that Laguna Colorada has a "wind tide." Each day in this part of the puna the wind, coming from the west, rose between noon and one o'clock to achieve steady, uncomfortable velocities until about 8:30 o'clock each evening when it gradually abated. The tide resulted when the wind pushed the shallow waters toward the eastern shores, whence it flowed back at night after the wind dropped. There was nothing to do but move the net to a new and safely dry location.

A mud bar, much favored by the flamingos and which stayed well above water, was chosen and the laborious business of washing the net and dragging it to its new location began. The cables from the cannons were laid under water to the lake shore, where we dug a rectangular pit large enough for me to sit with the blasting machine and camouflaged it with clumps of high grass. I took up the flamingo vigil with the telescope trained on markers in the water which indicated the exact place the net would fall if fired. Though it was uncomfortably cool, the sun beat down through the thin air with skin-searing force, and

Setting up tents on the shore of Laguna Colorada was not the simple business it normally would be, on account of the violent and bitterly cold wind that came up between noon and one o'clock and continued blowing until 8:30 in the evening. The bright sunshine burned rather than tanned and while the temperature rose to 70 degrees by day, it fell to 5 degrees during the night.

The metal tubes — one being thrust into the mud and another already in place — are the "cannons" used to shoot light nets over the flamingos. The charge was fired by means of a cable stretched to a blind not far away. Cannon net traps have been used successfully in netting ducks, but they failed to work with flamingos and eventually the party resorted to snares.

it was necessary to protect my hands and face with sacking to avoid severe burns.

Soon birds began pitching down from the sky and alighting near the cannons, first two, then four, then increasing numbers until I could count 221 birds walking, preening and occasionally squabbling near the trap. There were 211 *jamesi*, 1 Andean (*andinus*) and 9 Chilean (*chilensis*), a fairly representative sampling of the lake's population, and we later determined that *jamesi* made up nearly 90%, *chilensis* about 8%, and *andinus* not more than 2% of the flamingos present. Gradually, the birds worked their way toward the blind and also toward the trap, but none actually entered the trapping zone. A warm spring which poured forth perhaps 15 feet east of the blind on the lake's shore was the source of attraction to the birds — a

favorite bathing spot — and they were soon within forty feet of the blind, drinking and dropping to their breasts in the water to engage in almost frantic bathing antics. Certain areas of the ankle-deep channel which the spring's current had established in the lake's shallows, seemed especially favored, largely because some individual had started bathing there, and one of these points was in front of the blind. Flamingos are often considered excellent examples of "reserved" birds by ornithologists; that is, they try to preserve "individual distance" and are almost never to be seen touching each other. The tremendous social stimulus to bathe broke down this pattern and the birds crowded in upon each other so that the entire group bathing ceremony was a constant noisy squabble with occasional birds rising to fight vigorously, and harmlessly, with the latest

the position of the birds near the net, all of which proved well out of range, I recognized a typical flamingo courtship chase: a large male trotting after a female very near the trap, their behavior almost exactly that of the American Flamingos I had watched and even built nests for at the Zoo. The displays of courting male birds are fascinating, and often, as anyone who has ever seen a peacock fan his train knows, beautiful performances. Flamingos are no exception, but no one has ever recorded the display of James's Flamingos and I could at least hope that we might eventually study it at length in the Zoo, where I had often observed American, European and Chilean Flamingo courtship ceremony. The most distinctive part of the elaborate display of these birds consists of slowly twisting the head to one side and back with deliberate, attention-getting



bath invader. Despite the birds' size and proportions, their bobbing, washing movements were almost exactly those of a barnyard duck, but what superb color! I could not help but wonder if the salt water of Laguna Colorada and the salt crystals I could see on the birds did not help give unusual impetus to the cleansing.

When I put my eye to the telescope to check

timing, neck extended to its greatest height. In 1958 Leslie Brown, an African ornithologist, had shown to a group of New York flamingophiles some magnificent movies of African Lesser Flamingos in certain lakes where populations may sometimes exceed two million. In Mr. Brown's pictures waves of semi-regimented courtship posturing could be seen at great distance so that



wing-opening ceremonies looked like a gradual red swell passing through a pink sea. Instead of head-twisting pre-pairing ceremonies, however, head dippings and neck undulations seemed to be the substitute.

As I recalled the courtship of the most abundant of flamingos, the opportunity to see that of the world's least abundant flamingo took on new significance. Today, there is still argument about the origin of the James's Flamingo; surely it is most likely to have developed from American Flamingo-like stock, but some feel that it may instead be more closely related to Africa's Lesser Flamingo. In any event, its three-toed condition seems to indicate relatively recent modifications which these other two divergent forms do not display, and we know now that behavior patterns are sometimes less modified by evolution than physical characteristics. Perhaps *jamesi* courtship behavior will some day shed light upon its relationships. My field notebook became filled with sketches and after a while I could begin to see a pattern in the sporadic courting activities of a large flock of preening, strutting flamingos between the blind and the net. While final definition of *jamesi*'s courtship postures will have to

A flock of James's Flamingos bathing and preening in channels leading from springs at Laguna Colorada. The two birds standing at the left of center, foreground, are a male and a female and the difference in their sizes is well shown. A population of about 4,000 birds was present at the time the Zoological Society's expedition visited the lake, but migration was then under way. Roger Peterson saw about 8,000.

await further study, it appeared that *jamesi* does not have a head twist posture, but does have a "tall strut" with the head bent sharply and the point of the beak buried in the feathers of the upper neck. This strut walk is interrupted, excitingly enough, by a greatly developed head-back posture with the neck doubled back and head turned sideways in a sort of ritualized preening motion, an exceedingly graceful posture. Males frequently indulged in the erect wing-stretching posture and used a bow with a low head twist and raised back plumes as an aggressive display. Thus, at this point, the full courtship of James's Flamingo is an enigma, but what we have seen does not resemble the distinctive head twist of the American flamingo.

Nine hours later I painfully straightened up and made my way in darkness to the camp. We had captured no flamingos but my head was churning with visions of their washings and woo-

ings, and that night as we huddled in the power wagon wolfing our dinners, we reviewed the trapping problem from every angle. First and foremost, we had discovered that the birds very rarely got within cannon range of any site where we could make a set. Normally, they walked about in water at least fifty or sixty feet from shore, and they were extremely wary and easily disturbed. Gerardo had noticed birds frequenting the water quite near the cannon trap very early in the morning, though they had moved away when we entered our blind. We decided to rise early and gain the blind before dawn. At 4 a.m. Gerardo, Mario and Leopoldo tactfully awakened me by singing loudly in their tent nearby, and Gerardo and I, shivering audibly, stumbled through the almost tangible cold along the lake shore till we finally reached the blind.

As Gerardo rolled up in his blanket on the frost-covered grass and I pulled a sack around as additional protection from the dampness of the vapor rising from the warm springs nearby, the moonless black gradually gave way to discernible grays, and we discovered flamingos, mostly Chileans, within 30 feet of us and feeding vigorously. Apparently the red waters of Laguna Colorada must swarm with food that is obtainable by flamingos, and perhaps by little else, for the numbers of ducks, geese and even shore birds were not great. The peculiar, complicated beak of the flamingo opens a food larder available to no other land vertebrate, for tiny plants and animals of lake mud and waters make up its diet. All six forms of flamingo possess a comb-like series of lamellae on either side of the maxilla, the "upper beak," and the size and closeness of these comb-teeth are probably a good indication of the relative adaptation for smaller or larger types of food among the flamingo species. Studies of the Lesser and Greater Flamingo which dwell side by side in Africa have indicated that the extreme specialization of the Lesser Flamingo's beak may account for the fact that the two forms can feed side by side, probably not competing for food, the Greater species eating relatively large items and the Lesser straining very minute food objects such as diatoms and blue-green algae from the water. A similar division of food habits may well occur at Laguna Colorada, where we found that Chilean Flamingos averaged about 17 or 18 lammellae per

inch of beak edge, Andean Flamingos about 23, but the James's Flamingo 53 or 54. As flamingos have the most complex beaks in the bird world, it is probably safe to say that the James's Flamingo has the most complicated of all bird beaks.

We saw further evidence that the three South American flamingos might actually be feeding on different foods in the same lake, for each species showed preferences in type of feeding area. *Jamesi* usually fed well out in the lake, often in large groups, and when it did feed closer in-shore it preferred areas of red water. *Chilensis*, on the other hand, was most often found feeding where fresh water springs ran or seeped into the lake — an interesting point, for Chilean Flamingos nest on fresh water lakes here and there in South America, in contrast to practically all other flamingos, which seem to be confined to salty areas. Andean Flamingos, though few in number, showed decided preferences for small inlets around the lake's edges, small ponds whose bottoms and banks seemed to consist entirely of white, salty mud. A study of the possible foods available in these areas would be fascinating, but for the time being we concentrated on watching just how the James's Flamingo fed in the hope that we might learn facts important to their health should we finally obtain some for the Zoo. We were relieved to see the *jamesi's* feeding behavior was much like that of other flamingos; although it did not tread the bottom with its feet, it often did feed with the head completely submerged.

The red color of Laguna Colorada, incidentally, is caused by tiny plants, mostly a type of algae called diatoms, and these plants appear to make up the bulk of *jamesi's* food.

By 8 o'clock that night the minor discomforts of our confined positions had passed into the usual excruciating cramps of "blind sores," but not one flamingo had entered the range of the cannon net. While the birds were regular enough in their habits, the trapping area, 75 by 30 feet, was proving too small in the open terrain of Laguna Colorada where even the most consistent of birds might be wary of any change in the readily-observed surroundings. It was evident that trapping the James's Flamingo, abundant as it was, would be a long and difficult task and one that might prove totally unsuccessful. Bates paraphrased Coleridge all too aptly with "Flamingos,

flamingos everywhere, but not one near the trap.” Subsequent patient days at the blind brought no better results, but our understanding of the daily flamingo routine became more complete, and we re-planted the net and prepared a new blind which was distinguished by its signal discomfort. Eventually, I found that a position of extreme supplication was the least uncomfortable, but sixteen-hour shifts, the last one of eight hours in strong wind and cold, would leave me almost too stiff to stand.

Finally, the birds appeared between the markers, three James’s Flamingos, and I put every ounce of energy into plunging the blaster’s handle home. There was a loud explosion and the expedition members came pouring forth from the power wagon where lunch had been under way, running up the shore; I, on my part, running from the blind. The flamingo flock took off in an excited flapping mass, but we had no flamingos. Apparently, the heat waves had distorted my view of the cannon trap and the birds I had seen were actually well outside the trap’s limits. We refolded the net, loaded the cannons and spent the rest of the day in a survey of lake shore areas for better trapping sites. The next day Lucho was stationed on the mountainside with a flag and the telescope, for from that position he could see the trap perfectly and signal me when to fire.

In the meantime the Indians had become aware

of our presence and Juanito Estelo Vilca, a young man of 22, appeared at our camp riding, of all things, a snappy English racing bicycle. Juanito proved friendly; he had come to Laguna Colorada every summer since childhood to collect flamingo eggs and had helped guide the Chilean expedition of 1957. Furthermore, he was a man of surprising wealth, owning more than 300 llamas. He told us he rented Laguna Colorada from the Bolivian Government for the sum of \$5 a month, for llama-grazing and flamingo egg-collecting purposes.

Juanito became a regular visitor, often eating with us and never leaving without some gift in the form of canned food or medicine for his ailing mother. He suffered from an eye inflammation himself, which our antibiotics soon cleared, and each of his visits helped our friendship. We questioned him extremely carefully on many aspects of flamingo biology and obtained useful information. For example, we were able to check previous reports that the Laguna Colorada flamingos remained at the lake throughout the winter; a statement we could hardly accept as we could see that a migration away from the lake was under way during our visit, and even in the relatively warm summer season, the period of our visit, substantial freezing occurred at the lake. It seemed unlikely that the warm springs could keep a large enough area open to support a major flamingo population. Besides, Lucho had made a short win-





Thirteen James's Flamingos in flight, high above the salt island in the background. Careful questioning of Indians at Laguna Colorada, and the observations of Luis Pena, have established that most of the population of James's Flamingos leaves the lake in winter. But where the birds go, no one at present knows.

Llamas graze the sparse vegetation along the shores of Laguna Colorada. These are part of a herd of some 300 animals belonging to Juanito, an Indian, who rents grazing and "egging" privileges from the government for \$5 a month.

ter visit to the laguna and found fewer than two dozen flamingos wintered near the warm springs. Careful questioning revealed that he meant only that a small number of birds stayed the winter, which tallied with our observations. Juanito was able to distinguish the three species of flamingos, with medium accuracy, so long as the birds were adult and in full color. The names he gave them are fairly standard local names throughout their range, according to Lucho. They were onomatopoeic words taken from the birds' most typical calls, and very appropriate as he pro-

nounced them: the Chilean Flamingo, "Tococo"; the Andean Flamingo, "Jetete"; and the James's Flamingo, "Chururo." Especially fascinating, however, was the fact that Juanito named still a fourth species which he insisted was not the young one of the preceding birds, but an adult breeding species. He called it "Guaichete." The 1957 expedition had confused the local names and attributed "Tococo" to *andinus*, "Guaichete" to *chilensis*, and "Jetete" to the fourth species. No ornithologist had ever seen the fourth bird and we redoubled our efforts with the telescope in an attempt to discover it, for it is not easy to discount the "Guaichete," as Lucho has found that Indians in other parts of the high puna also distinguish the four species. Yet, despite repeated questions over a period of many days, we were unable to get a consistent description of the bird from Juanito, except that it has a "pink bill and red legs and is most like the 'Chururo'." In any event, we saw no flamingo which could not readily be distinguished as one of the recognized species.

Still another facet in the *jamesi* mystery concerned the obvious business of feather replacement. Some waterbirds, such as ducks, geese and swans, drop and replace all of their wing feathers at one time, a process which renders them temporarily flightless. American, Chilean and Greater Flamingos do this as well, and probably all flamingos do. However, though the shores of the lake contained feathers in sizeable windrows, not a single flight feather could be found among them, and we saw no birds incapable of flight. Juanito stated that he had never seen an adult, uninjured bird that could not fly. Usually, the flightless molt takes place during the latter part of the breeding season, just before the young of the year are about to fly, but it appears that most of the Laguna Colorada birds migrate before molting — possibly to some of the large salt lakes at somewhat lower elevations, for neither *andinus* nor *jamesi* actually winters at the coast as has been reported.

Late one afternoon, Juanito reported that the Indians were going to take eggs from the colony nearest our camp in the morning. With our telescope we had spotted four colonies from the mountain behind the camp, and the Indians knew of and egged two more whose location we could not ascertain. To us, the thought of eating the eggs of the James's Flamingo was incredible, even more so as Roger had told us that it appeared every single egg was taken. Juanito at first affirmed this; however when we discussed the matter at length — a very necessary precaution as first impressions are likely to be deceiving in dealing with these people — he volunteered some fascinating facts, including the key to the present-day survival of the James's Flamingo. The colonies at Laguna Colorada have almost surely been thoroughly and repeatedly robbed of eggs from the time of the Incas. First, it appears that the birds will re-lay if their first and perhaps even if succeeding clutches are taken, although field observations on the American Flamingo have cast doubt upon that bird's ability to lay second clutches in the wild. Second, although the Indians raid the same colony at two-week intervals through much of the season, they carefully test all of the eggs before taking them from the colony, by the simple expedient of seeing whether they will float or not. If an egg floats, the egger knows it is not

fresh, but fertile, with a large embryo and well-developed air cell, and is not good to eat. Consequently he puts it back in the nest. It is probable that almost every James's Flamingo, curious as it seems, is handled by human hands before it ever hatches. The Indians knew where there were numbers of chicks, though we saw only one.

In addition to the Indians, we suspected that the great Andean Gulls were an important predator of the birds' eggs. I found freshly broken eggs upon several mud bars far from the colony, and during an exploratory climbing of the mountains behind our camp we chanced upon a large area of black lava peppered with broken flamingo eggs. They must have been carried at least two and a half miles from the nearest colony. A few Andean Caracaras frequent the area and it is possible that they are the major culprits, but the circumstances are all too suggestive of gulls. Still, once a flamingo has passed through incubation and early growth to the point where it can fly, its enemies are almost non-existent and apparently its food is abundant. A European Flamingo lived more than forty years in the Philadelphia Zoo until it succumbed as the result of an accident, and there seems good reason to believe that James's Flamingos may often attain great age even in the wild.

Eventually, Lucho was able to persuade Juanito to leave a few eggs in the colony scheduled for egging on the morrow for at least two more days, so that we might make photographs and perhaps capture known pairs which would be more likely to breed at the Zoo. Negotiations involved much tact on both sides, for we could not safely allow the Indians to think we censured egging. (Actually, the birds owe much to these people and their restrained egging, for they might have turned to shooting, and some Chilean Flamingo colonies in South America have been completely destroyed by guns.) On Juanito's side, it would be necessary to gain his people's consent to leave eggs, and to return to the colony himself for the remainder. The following day we prepared the cameras and cannon nets and erected Lucho's folding boat. Lucho posted himself on a mountain with the telescope, and carefully watched the path the Indians took on their way to the colony, for we knew the mud to be terrible and the Indians would take the easiest way.

Roger had grimly shown me pictures of Lucho up to his hips in mud and stated with heartfelt emphasis that his own trips to the colony in Laguna Colorada were "horrible." Lucho simply put it that his struggle to the colony with Peterson had been "the worst experience of my life."

The following morning Juanito did not appear on time to guide us and, with the wind due to come up in the afternoon, there was nothing to do but start the two-hour trek without him. Lucho had warned us that it was impossible to wear hip boots in the mud, for the suction would anchor us firmly, so Bates and I merely donned heavy socks and waded into the water, despite a thin glaze of ice which the sun had not yet fully dispelled. Leopoldo and Gerardo followed us, pulling the heavily-laden boat. At first the going was easy and the white mud nowhere more than ankle deep below the red water, but the frigid water and occasional sharp salt crystals soon made our feet ache terribly so that we welcomed the numbness eventually induced by the cold. Gradually the water became shallower and I had to help Gerardo and Leopoldo drag the boat through the mud. It became deeper and stickier, making the withdrawal of each foot a major effort.

In the meantime Lucho had climbed to his

Two James's Flamingo nests are in the foreground. Despite the soft, bottomless mud of the colony's home, the nests themselves were hard and solid. Some stood 7 inches above the mud, protecting each pair's single egg from the wind tide. The oval eggs measured 3 to 4 inches in length; broken ones had red yolks. The incubation period is unknown, but probably about 30 days.

mountainside perch and every 200 feet or so we would stop, try to get our breath in the rarified air, and use the binoculars to see which path his flag indicated the Indians had taken the day before. Only occasionally was the water deep enough to float the boat, and to hamper us still further the bottom became more treacherous. It seemed to consist of successive layers of plasticine-like mud and crystallized salts. As our feet slid through mud to rest on what felt like a solid bottom, the shifting of our weight to take another step caused us to crash down through painfully abrasive layers of salt. The bottom was riddled with apparently bottomless holes where subterranean geysers pour into the lake. We found it important to stay close so we might drag each

other out of these holes. Progress became a series of short struggles punctuated with rest periods while we stood covered from head to foot with mud and gasped at each other. As we approached a large salt island that gave promise of a place to sit and rest, Gerardo remarked, "Here Doctor (Peterson) crawl on knees."

The gabbling noises of the flamingo colony were close and we could now see outlying parts of the nesting area which lay perhaps four or five hundred yards further. Behind us Leopoldo spotted Juanito floundering through the mud. He had arrived late but, endowed with the enormous chest and lungs of the Andean Indian, was rapidly catching up with us. After we beached the boat on the salt island and rested, Bates and I



crept toward the ridge of the island to scan the colony. Then I realized how far we had pushed our endurance, for as I crawled forward with my head down I felt dizzy from the blood surging in my temples and noted my vision blurring with each heart beat.

We lay on the salt and carefully scanned the colony; it consisted almost entirely of James's Flamingos, although eight Chilean Flamingos stood in one part and a single Andean Flamingo in another. The colony was spread out upon three separate islands, all so low that we knew the water must cover the bases of the nests during the wind tide. A few groups of nests were widely separated from the rest of the colony, and these the Indians had failed to rob. We could see that the birds were still greatly disturbed from the Indians' raid, but that a few were incubating in nests on the center island where the Indians had left eggs for our photographic and trapping efforts. The situation did not look favorable for our project, but having come so far we had to continue. Juanito joined us and pointed out the best way to the colony and we started out on the last lap of the journey, taking pictures as we went, only to find the mud worse and the bottom more treacherous than anything we had yet attempted. The colony itself rested upon the most incredibly impassable bottomless muck of all. Certainly no non-flying predator other than man will ever endanger flamingos in such a place. The nests were the typical high mud mounds which flamingos build whenever they can, the world over. We examined the colony carefully and began the business of setting up the cannon net trap, which proved the most difficult feat of the entire journey. For two and a half hours we struggled through the mud, first building mud bases to support the heavy steel cannons, then making a 75-foot launching platform upon which we could rest the net protected from the mud, and finally stringing cables to a distant salt island where I might hide and discharge the cannons if the flamingos returned. The task was made doubly difficult by the knowledge that we faced almost certain failure.

As we feared, the birds showed no sign of returning to the area where the net was installed. The wind was blowing violently and the temperature steadily dropping (it reaches a maximum of

about 70°F. at noon in summer, and drops to about 5°F. above zero at night), and we had to get back to the shore soon or we might have been caught in a serious storm. By the third day it was obvious that our attempt had been in vain. We even removed one of the power wagon's headlights and wired it to an extra auto battery, for we were becoming desperate and considered trying to catch the birds by hand at night by jacklighting. I knew of a case in Africa where this method had proved successful and Lucho had heard that Chilean Flamingos were occasionally captured in this way. Our second trip to the colony and return to camp to bring the boat and gear was a terrible experience. Lucho accompanied Bates, Gerardo and me on this trip, and without someone to guide us from the mountainside we were unable to find our path of the day before until we were well out into the lake. The new way was a much more difficult one despite Lucho's wonderful Chilean-English adaptations, the best of which was, as Bates's now bare and bleeding feet showed momentarily above the mud, "Look, Bates has lost his sockets!" The boat was now laden with more than 300 pounds of equipment, for the net itself was so heavy with mud that two of us had to wrestle it over the gunwales, and we had to stop and rest every few steps. We were still about half a mile from shore when Lucho, who had fallen slightly behind, said in his quiet, formal way, "I cannot continue." He had silently pushed himself to the point of collapse. Despite his protests, Gerardo helped him into the boat and we pushed him as far as we could, until he insisted he could walk despite terrible leg cramps. That night Bates was shaken with repeated attacks of violent shivering during which he could scarcely talk. Laguna Colorada had enforced our respect.

The next day we awoke discouraged and still exhausted. Lucho's leg cramps were still serious, yet our remaining time in which to obtain the flamingos was growing shorter and shorter and we *had* to make further attempts. Gerardo and

Mr. Conway holds the first James's Flamingo captured by the expedition — a male. Males can usually be distinguished from females by their much larger size and proportionately heavier beaks. The bird has been wrapped in a sack to immobilize it temporarily while other birds were taken from snares. Wild as they are, the James's Flamingos showed little fear.



young Jorge, who had been very ill with altitude sickness, spent much of the day washing the boat and cannon nets. Bates fumed over his mud-caked cameras and discovered that the sun had burned a hole completely through the shutter of one camera, that the viewer of another was missing, and that still another had a damaged back. Lucho and I began work on a new trapping scheme — snares. The special fishing line I had purchased in New York was cut in short lengths and tied in little nooses until we had completed several hundred. Our idea was to fasten the snares under water near one of the flamingos' bathing areas in the hope that some of the birds might step through the loops and entangle themselves. We would watch from a point nearby and run out to release them. That evening we set more than 100 snares, had an early dinner and took the jeep to the far side of the lake. We took along the portable headlight that Gerardo had prepared.

The nights at Laguna Colorada could be beautiful beyond description and this night the moon was nearly full, so bright that Bates made successful color movies of it with normal daylight shutter speeds. At 7:50 p.m. we were entertained by the fiery descent of a shooting star. Lucho and I, quietly stalking along the shore with our light, found the bright moonlight against our jacklighting scheme, but at least we could determine whether the flamingos came near the shore where we might reach them on a cloudy night, or whether they roosted safely out toward the center of the lake. The almost cricket-like twittering of the James's Flamingo could be heard everywhere, but we soon found that they were well out in the lake beyond the reach of our powerful light. Night trapping with lights was another dead end.

Gerardo and I were up early the next morning and after scanning the area where we had fixed our snares I had started toward one of the springs with my toothbrush when Gerardo shouted, his eyes half starting from his head. "Two *jamesi*!" He was right. Two James's Flamingos had just become ensnared, and after pulling at the noose for a minute were standing stolidly, each captured by one foot. In thirty seconds the camp was bustling, Gerardo and I already in hip boots and Bates struggling into his "longies," shouting "Wait! Wait for pictures!" It was all we could

do to wait, for I was afraid the birds might hurt their legs if they struggled in the snares. Later we learned our worries were unnecessary and that the birds were never injured if removed in a reasonable time. With Bates taking pictures as we ran ahead, Gerardo and I crashed through the ice toward the birds, fearing they would escape at any instant, but within a few minutes we were holding the two first James's Flamingos ever captured alive — a large, heavy bird, probably a male, and a much smaller one, we hoped a female. They were lovely with a grace and petiteness not found in any other flamingo, and despite their sturdiness we carried them as if they were oversized Christmas tree ornaments. At the camp each bird was clothed in a sack, placed in the shady power wagon, and given an opportunity to become familiar with the strange creatures who gazed at them with such admiration. Soon they were calling and even squabbling a bit, and we judged it time to introduce them to the enclosure we had constructed out in the water near a spring. As I released them in the enclosure, I was astonished to find that they showed so little fear that they would strike out at me as though I were another, though exceptionally ugly, flamingo. The male was unsteady from his recent confinement in the sack and accepted my support without protest. Soon the female took a little food from my hand, all of which Bates faithfully recorded on film. Eventually we captured twenty James's Flamingos and, by chance, one Andean Flamingo. The latter was weakened by the trip home, over the mountains and then by air from Antofagasta, and survived only a few days. But late in March we were fortunate enough to receive two Andean Flamingos from Peña, and consequently we now have all six species.

The sexes of our James's appear to be evenly divided and we hope some day the little "Chururo" will breed at the Zoo. Unlike the members of our established flamingo collection which have maintained their wildness, the James's Flamingos are astonishingly unafraid and have become so used to handling and constant observation that they will actually bathe between my feet when I don boots and enter their pool in the Zoo's Aquatic Bird House Annex.

We no longer wonder, with Allen, whether the James's Flamingo "still survives."

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON



The 14-inch snowstorm of March 3 must have been a special day in the life of our **TAKIN** from the mountains of northern Burma. Although a commodious shelter had been provided in the yard of the Antelope House, the Takin almost never enters it. During the snowfall, it stood out of doors in the full fury of the storm and afterward played awkwardly in the snow.



These two photographs of the nesting of our **BLACK-NECKED SWANS** from southern South America were made within 24 hours of each other — just before and just after the March 3 snow. Unaccustomed as she was to deep snow, the swan stayed on her nest as snow mounted until only her head and neck were visible; her more active mate was not buried, but he kept her close company. Her first egg disappeared; the next two were removed and placed in an incubator, and a fourth egg, deposited on the day of the snow, was broken by freezing when the swan was forced to leave the nest to avoid being completely buried. The two eggs in the incubator appear to be fertile and are developing normally. Incubation is 34 to 36 days. This is the first time Black-necked Swans have nested in the Zoo.



Although they are still affectionately called the "Little Women," the young **CHIMPANZEES** in the Great Apes House have begun to grow up. Their strength has increased proportionately — witness this automobile tire casing which, in play, they twisted until it was turned partly inside out and their keeper was unable to untwist it. The Little Women are now being replaced by four new Chimpanzees approximately a year old — unlikely to wreck the tires given them as playthings.



All has been quiet and friendly in the **HIPPOPOTAMUS** pool in the Elephant House since — as reported in the last issue of "Animal Kingdom" — Phoebe allowed her mate, Peter, to share the pool with herself and her baby. Now all three bathe together peacefully and feed together or lie in close proximity as they sleep in the stall above the pool. The baby was born on December 16 and was just under 15 weeks old when this family group picture was taken. The youngster is a female.





*Greater Kudu bulls on the edge of the
Etosha Pan in South West Africa.*

Photographed by George Treichel

Report on the African Wild Life Fund

By **GEORGE WALL MERCK**

Secretary of the Zoological Society

ALITTLE OVER A YEAR AGO, the Zoological Society established a fund to carry out projects on behalf of the wildlife heritage of Africa. Since the announcement of this Fund, Members and friends of the Society have contributed \$25,756.50, which has enabled us, in conjunction with The Conservation Foundation, to start a number of projects and indicates the interest and concern of our membership in the plight of wildlife in Africa.

More than one person close to the wildlife situation in Africa has estimated that without appropriate conservation measures, the magnificent fauna of that continent cannot survive in satisfactory numbers for more than five years in the face of current trends. Whether or not the outlook is quite as bad as that, there is, on the other hand, no question but that the situation is a highly critical one. As one of many examples, the situation in the Albert National Park, can be

cited. Since this Park was created in 1925 and extended in 1929, the Institute of the National Parks of the Belgian Congo has been able to give virtually complete protection to the unique Mountain Gorilla. Today, this sanctuary is threatened with irremediable destruction. An explosive increase in the uncontrolled herds of cattle and a shortage of grazing land have resulted in cattle being driven deeper and deeper into the Park, and the Institute has been unable to stop this invasion. This situation is particularly disheartening when one considers that not a single head of cattle is killed for consumption; cattle represent only the social status of the owner.

Economic progress also takes its toll. Dams are built, such as the Kariba on the Zambezi in the Rhodesias. This lake, which will cover 2,000 square miles when it is finally filled in 1963, has already caused severe destruction of animal life. Such developments plus the constant incursion

of agriculture and cattle into formerly preserved areas are seriously diminishing and even eliminating many former wild animal habitats.

In the face of these enormous man-made changes all over the continent of Africa, the projects thus far undertaken by our Society seem slight indeed. Nevertheless, we are convinced that we must do all we can to help preserve at least a part of the landscape and its wildlife for posterity.

Projects initiated through the Fund since its inception can be roughly divided into three categories — scientific, educational and personnel.

The last category needs some clarification, for it does not mean that the Fund is burdened by administrative expenses. Quite the contrary, except for one appropriation which was made last year to enable Mr. Noel Simon of the Kenya Wild Life Society to give full time directly to conservation work, the Fund has borne no other expenses which could be classified as administrative.

A grant from the Fund was made, in conjunction with the United Nations Bureau of Technical Assistance Operations, to enable Major Bruce Kinloch, Game Warden of Uganda, to spend about four months in the United States studying game management. This experience, it is hoped, will help Major Kinloch expand conservation practices in Uganda on his return.

The Fund has also made a grant, to be administered by the Museums of Southern Rhodesia, to Senior Game Scout Sidney Simpelwe, a highly qualified African in the Game Department of Northern Rhodesia. This grant will maintain Simpelwe for a period of two years with scientists from the United States engaged in research under Fulbright scholarships in the Rhodesias. He will take part in studies now in progress, which include analysis of the habitats of big game animals in Southern Rhodesia, food habit studies of wild ungulates and predators, analysis of government operations directed toward the elimination or control of large mammals, and many related projects.

The major scientific project which the Fund has supported relates specifically to the development of an immobilization technique for use on large animals. Such a technique will enable investigators to shoot a drug-filled dart into an animal to put it to sleep for a brief period for exami-

nation and marking. Once marked, the animals can be followed to determine migratory cycles and other phenomena so that data can be obtained regarding their requirements for food and space related to their conservation needs. This work is being conducted by Dr. A. M. Harthoorn and Mr. J. A. Lock of the Faculty of Makerere College, Kampala, Uganda.

The fund also assisted Dr. Helmut Buechner in obtaining motion pictures of some aspects of habitat destruction in Uganda, Kenya and Tanganyika. This footage will be included in a proposed film to be used for conservation education.

Another film entitled "The Birds of East and Central Africa," photographed by Bayard Read, was produced in cooperation with the International Council for Bird Preservation. Copies of this film have been presented to The Fauna Preservation Society of Great Britain, the Congo National Parks, the Uganda National Parks and the Kenya Wild Life Society.

The Fund has also given assistance to the well-drilling program in the Kenya National Parks to provide new waterholes and to several scientists to enable them to attend the Game Wardens' Conference in Northern Rhodesia.

Other grants are presently under consideration, such as supporting the essential project now being carried out in the Mara region in Kenya by Lee Talbot of the University of California, for the study of the migratory patterns and ecology of the wildebeest and other plains animals, and activities aimed at educating African leaders in the essential values of wild life for the future of the territories which are coming more and more under their direct control.

Much more remains to be done, and the Society is anxious to take its share of the responsibility for doing it. Our work to date seems limited, but we have been told by Alan Moorehead, the author of "No Room in the Ark," that "the Society's work is appreciated in East Africa. . . . indeed in many ways you have done more than anyone, and no one who is interested in the wild life there forgets it."

Reprints of this article are available to Members of the Society for distribution to interested persons.



The first Sand Tiger Shark to travel across the continent by air makes itself at home in San Francisco's Steinhart Aquarium. This is one of the few large sharks that do well in captivity.

San Francisco Examiner Photo

Sharks Travel by Jet, Too

By JAMES W. ATZ

Associate Curator of the Aquarium

SPEED IS ONE of the characteristics of our times. Not fifty years ago it took more than a week to cross the continent by the fastest means available. Today's jet planes make the trip in less than five hours. This forty-fold acceleration of travel has revolutionized the transportation of animals. Long distance trips that once required complicated arrangements and specially-trained men to care for live cargo can now be made with the aid of a simple travelling case and a few telephone calls. The time an animal spends in transit is frequently so short that no feeding or watering is necessary. Certainly this holds for fish; trips that used to take weeks are now completed in less than a day. But the shipping of fish necessarily involves an additional complication: water. It was the water that limited air transport to relatively small fishes —

until the Aquarium's recent shipment of a Sand Tiger Shark to San Francisco showed otherwise.

The trouble with water, of course, is that it weighs so much — eight and one-third pounds per gallon — and under ordinary conditions fishes need an enormous weight of it to sustain them. A two-inch Goldfish, for example, must have at least two gallons to keep it healthy — nearly 17 pounds of water. Larger fish and more active species such as trout require proportionately much more. With such weights, even a short trip by air freight or air express would cost many times the worth of the fish. Until the advent of the method of shipping fish in sealed plastic bags, the airplane was economically out of the question as a means of transporting fishes.¹

¹ See "Now Fishes Come in Plastic Bags" by the same author in *Animal Kingdom*, 61: 27-28, January, 1958.

The waterproof plastic shipping bag with its cardboard container was developed to satisfy the needs of the tropical fish industry, which moves hundreds of millions of small, tropical freshwater fishes each year from far-off places such as Singapore and Manaus, or from breeding farms in Florida to fanciers in urban areas all over the United States and Europe. At first only short flights were feasible, because the fish had to be crowded to such an extent, in order to make an economic load, that they tended to smother after a few hours. But the substitution of an atmosphere of pure oxygen for the air ordinarily sealed inside the plastic bag greatly increased the time that fish could remain packed. This made possible routine long-distance shipments.

A lack of oxygen is not the only limiting factor in maintaining fish in closed containers where waste products can accumulate to such an extent that the fish poison themselves. Carbon dioxide, which fish give off into the water just as terrestrial animals do into the air, is a poison. In fact, some kinds of fishes are so sensitive to it that a small amount of this gas dissolved in the water surrounding them will prevent them from utilizing oxygen, so that they are asphyxiated even when plenty of oxygen is present. Chemicals that will combine with carbon dioxide, keeping it in a physiologically inactive state, are known, and a few of these can be used since they are harmless to fish. Another method is to drug the fish and thus slow down the rate at which they produce carbon dioxide — and consume oxygen, as well. The use of drugs and other chemicals further increased the distance that small fish could be shipped commercially and also the number that could be packed safely into a given bag.

These improvements applied only to the transportation of fish less than six inches long, however. Although the Aquarium and its sister public institutions made use of the new techniques to obtain and exchange small and, occasionally, medium-sized fish, there seemed little possibility of shipping larger specimens, three feet or more

in length by air in plastic bags, simply because the amount of water required would have been too great and the cost prohibitive.

As far back as 1951, however, Dr. Earl S. Herald had begun a series of tests and experiments that eventually showed how the plastic bag method could be adapted to large fish. As Curator of the Steinhart Aquarium in San Francisco, Dr. Herald wanted to develop an economical method of shipping good-sized fish. For experimentation he chose the Leopard Shark, a species readily available to him in sizes between one and two feet. This attractively marked, hardy and active shark makes a good exhibit, desired for this reason by other aquariums. At first, Curator Herald and Associate Curator Robert P. Dempster tried the old-fashioned metal shipping cans in conjunction with oxygen generators, but they soon shifted to the new plastic shipping bags. Their determinations of the amount of oxygen consumed by Leopard Sharks of various sizes convinced them of the feasibility of sending these fish to other public aquariums by air in plastic bags with pure oxygen. Successful shipments to San Antonio, Fort Worth, Miami and New York subsequently proved them right. At the Aquarium, we still have on exhibition Leopard Sharks shipped to us in May, 1957, from the Steinhart Aquarium.



Dr. Ray and Director Coates take a firm grip on the 41-inch Sand Tiger Shark they are preparing to put into its shipping box where it will be sealed in plastic for its trip by air.

When Dr. Herald visited us two years ago, he was so favorably impressed with the Sand Tiger Sharks we had on exhibition that he declared that he would not rest until the Steinhart Aquarium also exhibited this species. A shark is a shark, one might be tempted to say and therefore to wonder what makes the Sand Tiger Shark so exceptional. It is just this: of all the species of sharks that possess a conventional *sharkish* appearance, the Sand Tiger is the only one that adapts itself readily to captivity, and even so it cannot be considered really hardy.

With sailors, swimmers and other people who meet up with them in their natural habitat sharks have a reputation for toughness. To aquarists, however, they are "softies" that require special care if they are to settle down successfully to a life in captivity.

Discussions with Dr. Herald brought to light no easy way of transporting a four- or five-foot Sand Tiger Shark to the West Coast. We even discussed the possibility of sending our specially equipped truck on the 3,000-mile journey. It might be thought that a baby shark would be suitable to send but at birth a Sand Tiger Shark is about three and a half feet long.

For the time being the project was shelved and the two institutions confined their swapping to specimens that could be handled in a routine manner. About a year later the establishment of regular non-stop jet service between New York and San Francisco reduced the flight time to less than five hours and Dr. Herald brought the shark project up again. He supplied a specially made cardboard carton, four feet long by 20 inches wide and deep, and several extra-large plastic bags to fit.

Not until several months had passed did we obtain two specimens that appeared to be small enough, although even they were somewhat larger than we would have preferred.

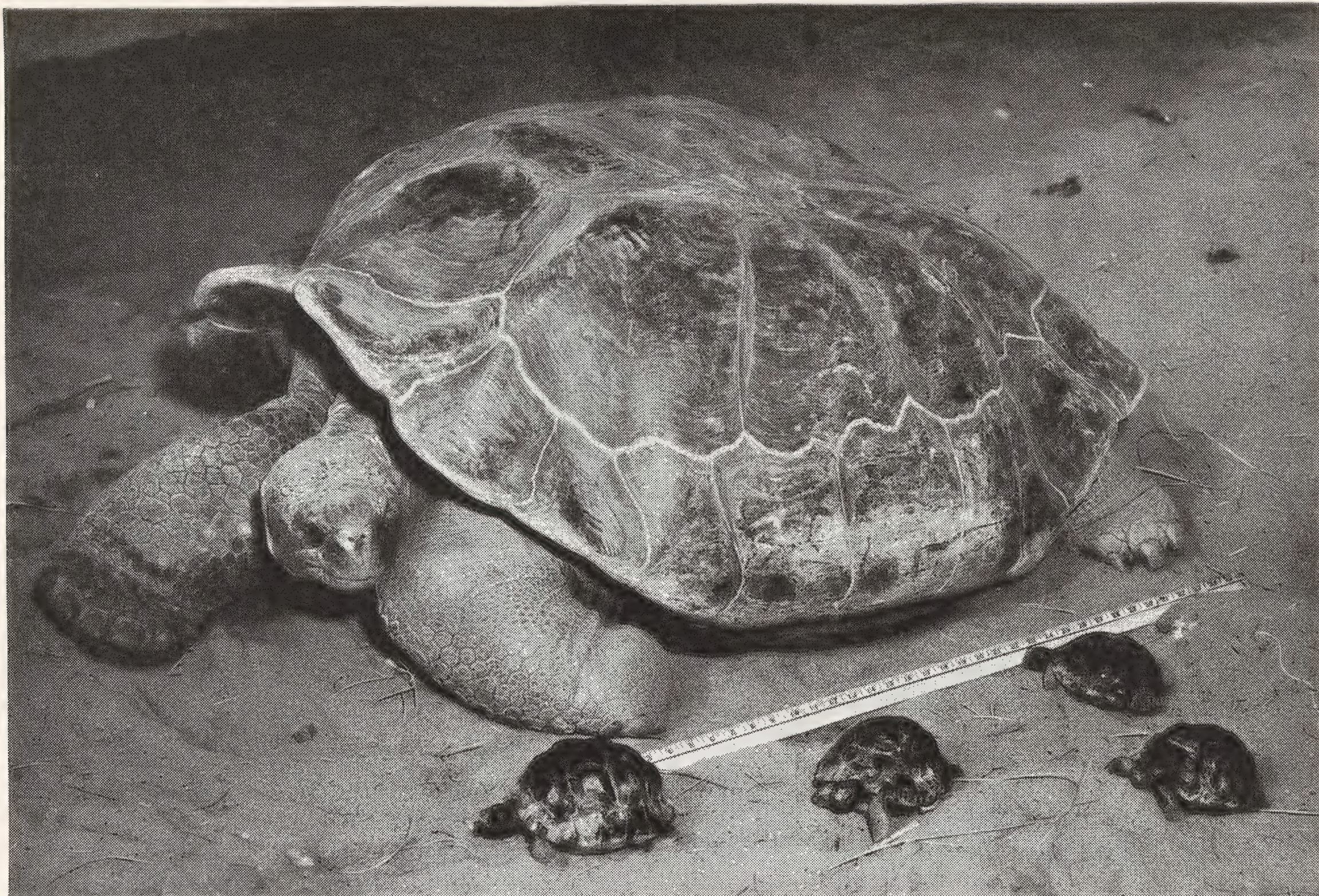
Dr. Carleton Ray undertook to see whether these sharks would live inside Dr. Herald's box and plastic bag under simulated flight conditions. Following Director Coates' suggestion, Superintendent Olsen designed a strong but relatively lightweight wooden box, lined with asbestos, to protect, support and insulate the cardboard container, and following the lead of two California zoologists, Dr. Ray decided to use a chemical

called "Tris Amino" to control the carbon dioxide.² In the critical test, a shark was sealed inside a double layer of plastic (that is, two bags, one inside the other) in sea water through which oxygen had been bubbled. Then the proper amount of Tris Amino was added. The rate of breathing of the shark was determined and its behavior recorded. The amount of oxygen dissolved in the water was measured before and after the test, as was also the acidity of the water — an excellent indication of the carbon dioxide present. For twenty hours Dr. Ray and Morris H. Baslow, biochemist in the Department of Marine Biochemistry and Ecology, watched over the shark. At the end of the test it was still vigorous and it subsequently showed no ill effects from its lengthy close confinement. Among other things, the test showed that Sand Tiger Sharks do not have to keep swimming in order to breathe properly, as some of us had believed. The shark did bite through the inner bag once, so subsequently we put newspaper between the two bags and this prevented any further damage. Most importantly, the experiment demonstrated that it was practicable to ship large sharks by air to the West Coast.

The rest followed routinely. On the morning of January 28, a 41-inch, 24-pound, male Sand Tiger Shark was sealed into triple plastic bags containing oxygen and 36 gallons of treated sea water. Although the operation commenced at 6:00 A.M., the press and television were well represented. At 8:00, the shark in its special container was delivered to American Airlines for their non-stop jet flight to San Francisco. Seven hours later, Dr. Herald opened the box and found the shark in excellent condition. Ordinarily it would have survived only a few hours in such a small amount of water.

Nearly a month later, following the same procedure, a female Sand Tiger Shark of almost identical size was shipped by air to the Steinhart Aquarium as a mate for the male. San Franciscans have been duly impressed with their sinister appearance. To aquarium men, however, they represent a victory over time, distance and shark nature.

² McFarland & Norris. *Calif. Fish and Game*, 44(4): 291-310, 1958. This Tris Amino (Tris-buffer) was supplied by the manufacturer, Commercial Solvents Corp., N. Y.



When they were a few days more than a year old, the four baby tortoises took their daily sun-bath alongside their mother, Nellie. She showed only a mild interest in the babies' movements.

Richard Van Nostrand—San Diego Zoo Photograph

FOUR BABY GIANTS

By CHARLES E. SHAW

Curator of Reptiles, San Diego Zoo

It has taken a long time, but a certain success is at last being achieved in the captive breeding of the Galapagos Tortoise, a project which the New York Zoological Society inaugurated back in 1928. The San Diego Zoo has found a combination of circumstances that permit breeding and rearing, and a report after the first year was published in the December, 1959, issue of the San Diego Zoo magazine, ZOO NOOZ. It was written by Charles E. Shaw, Curator of Reptiles, and is reprinted here by permission of the San Diego Zoo. — Ed.

THIRTY-ONE YEARS AGO Dr. Charles H. Townsend, late director of the New York Aquarium, set out for the Galapagos Islands in an attempt to save from extinction the remarkable gigantic tortoises of that archipelago. The expedition was under the sponsorship of the New York Zoological Society, sailing on the steamer *Albatross II* of the United States Bureau of Fisheries.

Beset by the appetites of man, as well as the carnivorous mammals that accompanied his visits to these islands, the formerly astonishingly abundant tortoises had shrunk in numbers to the point where many naturalists feared for their continued existence. Their plight was told in Dr. Townsend's own words as follows:

"With the wondrous tide of tortoise life brought to a low ebb in the nineteenth century by man, there followed no rise when he withdrew. The pests he had introduced proved sufficient to prevent any increase among the scattered

survivors. Dogs, pigs, cats, and rats abandoned there returned to the feral state and increased to thousands. The eggs and newly hatched young of the tortoises became their food, few escaping. The adults, wearing their shell of armor, were largely immune.

"Then followed the Ecuadorians, who killed tortoises assiduously for their oil. The animals have long been extinct on eight of the islands where they once swarmed. Wild dogs and other predatory pests roam in thousands on the two large islands where limited numbers of adult tortoises still are to be found — mostly far inland."

Dr. Townsend and his party of tortoise collectors returned 180 young tortoises to New York, all of these being collected in the mountains of southern Albemarle Island, in the Galapagos group. The object of Dr. Townsend's expedition was to obtain enough tortoises to establish captive breeding colonies in southern latitudes in the United States and other parts of the world, and thus to perpetuate this remarkable animal species. To this end, tortoise colonies were established at the Botanical Gardens, Panama Canal Zone; the San Diego Zoo; the Boyce Thompson Arboretum, Superior, Arizona; the Zoological Gardens of Houston and San Antonio, Texas, and New Orleans, Louisiana; the grounds of the Aquarium in Bermuda; the Honolulu Zoo, and the Taronga Park Zoo, Sydney, Australia.

Though all these tortoises were still very young, it was hoped that eventually they would reach maturity and breed. In the meantime, during their early captive years, the young tortoises in the several hoped-for breeding colonies served to supply data on growth rate in this species. Except for a single tortoise from Albemarle Island that had resided in Riverside, California, from 1899 (when it weighed 29 pounds), until its death in 1914 (when it weighed 415 pounds), little was known concerning the rate of growth of this tortoise. Indeed, large size in the Galapagos Tortoise is not truly indicative of great age!

Anticipated breeding results in the captive tortoise colonies established by Dr. Townsend were slight and sporadic. As reported in *ZOONOOZ* (December 1958), only six captive breedings and hatchings of this species had been recorded.

Late in 1957, with a view to aiding the breeding of its own Galapagos Tortoise colony, the

San Diego Zoo modified its existing Galapagos Tortoise enclosure. The entire upper end of the area was dug out to a depth of about forty inches with a bulldozer; and the soil thus removed was replaced with sand. This, we hoped, would do the trick insofar as tortoise reproduction was concerned. In many years past, the tortoises had tried to breed, and evidently without success — for all eggs previously incubated had not hatched and, upon examination at a later date, had proven infertile.

On February 16, 1958, a female laid a clutch of eggs in the sandy area of the tortoise enclosure. These were removed to the constantly warm interior of the reptile house the next morning. Little attention was given the eggs. Then on October 21, 1958, a scratching sound emanated from the glass covered crock in which the tortoise eggs had been incubating for 246 days. Almost thirty years to the day since the attempt at an experimental breeding colony in the San Diego Zoo our Galapagos Tortoises had produced the desired results.

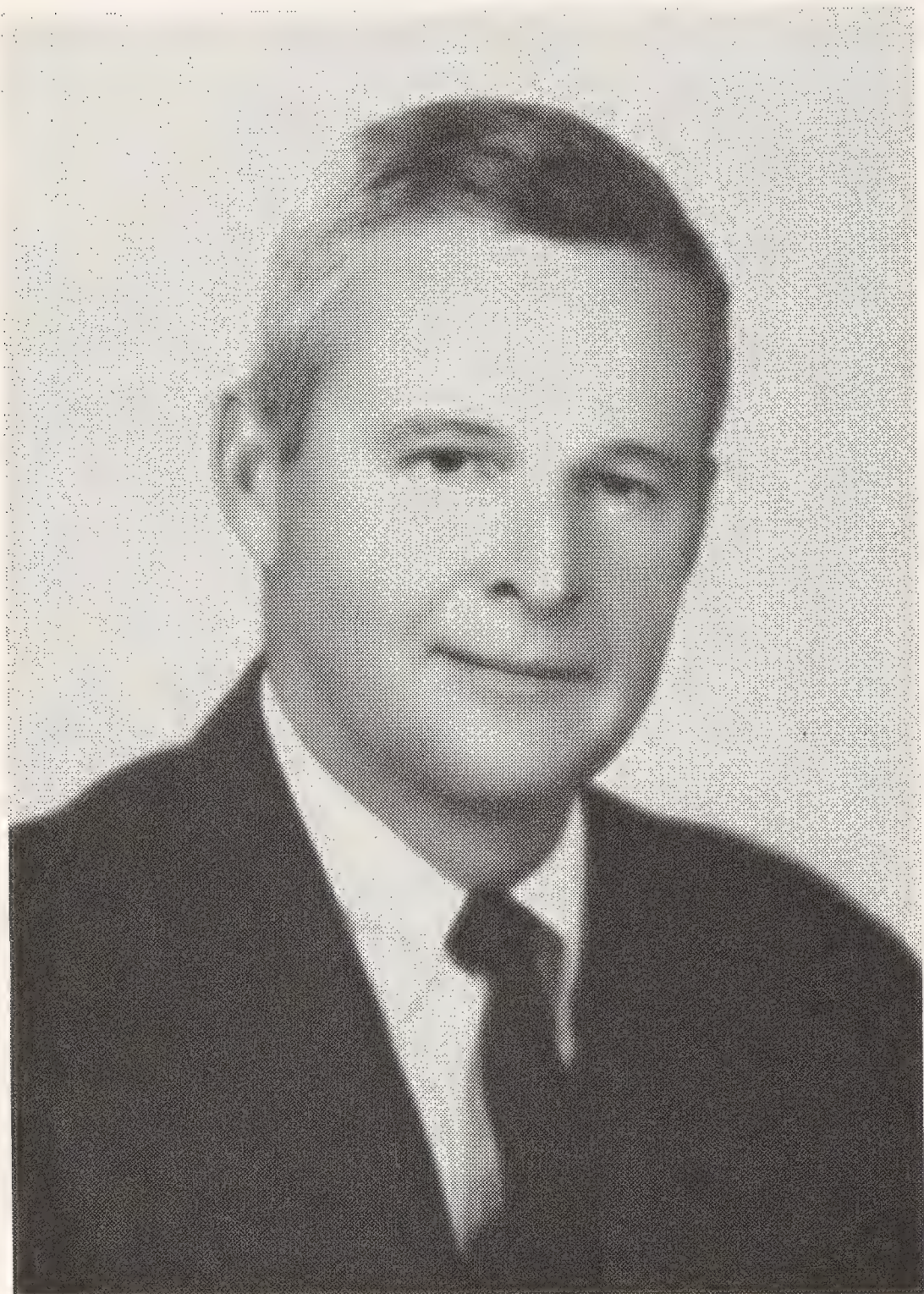
Previous growth statistics of the young tortoises collected by Dr. Townsend and his party had shown that this species grew quite rapidly. However, those of us at the San Diego Zoo who were watching the monthly progress of our tortoise hatchlings were hardly prepared for the phenomenal increment in weights and dimensions shown after one year. Of the five specimens found at the surface of the sand incubator on October 21, 1958, four are alive and thriving; one died on December 10, 1958.

The four surviving specimens have grown at a remarkable rate on a diet of finely chopped lettuce, carrot pulp and bone meal. All increased their weights by about 1000%, with the exception of one outstanding individual, which showed a weight increase of 1403% after one year. Straight-line carapace length increases in all hatchlings exceeded 200%. The following table shows a comparison of the weights of the tortoises as noted on the date they were hatched and one year later:

Tortoise	10-21-58		10-21-59	
	Grams	(Ounces)	Grams	(Ounces)
1	63.1	(2.2)	601.0	(21.0)
2	66.9	(2.3)	664.6	(23.2)
3	69.0	(2.4)	968.4	(33.9)
4	60.9	(2.1)	527.3	(18.4)

CONSERVATION

FOUNDATION



Stephen Whitney Blodgett

Our most recent staff member brings active and personal knowledge of conservation problems which may have existed in the lives of most people as pure theory heretofore. In 1931 Stephen Blodgett started farming on a commercial scale with a success which over the years gradually increased his holdings to 3,000 acres of tillable land in truck crops in New York State plus a winter operation in Florida.

In 1958, however, due to inroads of development and industrialization of farm areas, he decided to suspend his operation. It was another example of Urban Sprawl vs. Agriculture.

Because of an abiding love and devotion to nature, with a particular interest in ecology, he turned quite naturally and with a little help from Fairfield Osborn to an active participation in the conservation of natural resources, with the Foundation a logical haven for his interests.

It is not without significance that Blodgett earlier served on ex-Governor Harriman's Advisory Council on Migrant Labor, acting as chairman of the Health and Housing Committee responsible for re-writing the health code pertaining to housing and general health standards of migrants.

He has made it a principle to maintain an intense interest in wildlife, land and water conservation, and intends to remain closely associated with all three in the continuance of his daily life.

Alaska's Recreation Potential

The Foundation has been formally requested by the National Outdoor Recreation Resources Review Commission to undertake a study of Alaska's recreation potential. The broad objective is a careful appraisal of the recreation resources peculiar to the new State and several members of the Foundation staff will participate in the project. Frank Darling will provide over-all direction. Wallace Bowman will review literature and make two investigation trips to Alaska. Richard A. Cooley, Research Associate located in Juneau, Alaska, will provide assistance to Mr. Bowman. Samuel Ordway will assist in preparing the final draft of the report.

Briefly Noted

Dr. Osborn will be the keynote speaker at the conference of the International Union for Conservation of Nature and Natural Resources, June 15-24, in Warsaw, to be attended by more than thirty nations. . . . "Teaching Science Through Conservation," a book for teachers by Martha Munzer and Paul Brandwein, will be published in April by McGraw-Hill. . . . Dr. Darling attended the 25th North American Wildlife and Natural Resources Conference at Dallas, Texas, March 7-9. . . . Foundation staff members will judge the finals of the Nature and Wildlife category at the American Film Festival in New York City, April 20-23.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Lai Likes People, But Not Other Tigers

When Dacca II, a handsome and healthy Tiger cub, was born on November 9, 1958, she was immediately removed from her mother, "Old Dacca," and hand-reared with the expectation that she would eventually be mated to a wild-born Tiger. Hand-rearing, it was felt, would keep her gentle as her own hand-reared mother had been.

Last October we obtained from Thailand a prospective mate for little Dacca II, a very large and very friendly male cub named Lai. He gave every prospect of being exactly what was wanted, for he, too, had been hand-reared in his homeland and he took immediately to his keepers here.

Late this winter — both of the cubs being something over a year old — the always-ticklish experiment of introducing them to each other was tried. They were allowed a generous acclimatization period of seeing each other with a barred gate between their two compartments in the Lion House. At last the gate was withdrawn.

Lai made one snarling leap at Dacca II and would have killed her if keepers had not instantly intervened and separated them.

And that is where our attempts to find a mate for Dacca II stand at present. Lai is still the fawning friend of his keeper, Dacca II is still gentle and trustworthy. It may eventually be possible to make friends between Lai and Dacca, but if not, all we can then do is to search for another wild-caught male and start all over again.

In the Animal World, Things Are Not Always What They Seem

The letter from a field man attached to a mining company in British Guiana was one to arouse the interest (and skepticism) of any Curator of Reptiles. It reported that he had captured a "20-foot Boa Constrictor" while working in a remote area. Did we want it?

After considerable correspondence the reptile

arrived. It was not a Boa Constrictor; it was an Anaconda. And it was not 20 feet long; it was 17 feet long.

However, we have only once before had an Anaconda as long as 17 feet, so the newcomer is welcome. It arrived in very poor condition, weighing only 112 pounds, whereas a snake of that length in good condition should weigh fully twice as much. At the moment it is on exhibition in the Reptile House and is being hand-fed.

Seven years ago an Anaconda sent to us as a "guaranteed 18-footer" was found on arrival to measure exactly 13 feet.

Dr. Osborn Honored Abroad

During his recent survey of the wildlife situation, which took him to England and East and Central Africa, Dr. Fairfield Osborn was made an Honorary Trustee of the Royal National Parks of Kenya and, in London, Honorary Vice-president of the Fauna Preservation Society.

"Jimmy" Has Been Superseded

Maximum longevities in captivity are important to Zoo people but are very difficult to come by, at least with proper certification. One of the best ways to unearth them is to print the best known to you and sit back! Results are bound to follow. When *Animal Kingdom* (January-February, 1960) made the claim that the 22 years and 18 days "Jimmy," our well known Kinkajou, had lived here, seemed to be a record, Gerald Iles, Director of the Montreal Zoological Gardens, wrote to Dr. Tee-Van, saying he had seen one in the Amsterdam Zoological Gardens, said to be older. We wrote Dr. E. F. Jacobi, Director of "Artis," who has replied that his Kinkajou, received on September 18, 1935, had died on April 17, 1959, after 23 years, 7 months. That *does* seem to be the best known longevity for a Kinkajou but Jimmy still clings to second place — that is, unless this note again brings results! —
LEE S. CRANDALL.

The Sea as a Medicine Chest

WATER HAS BEEN CALLED the universal solvent, and as far as lakes and streams and the sea are concerned, with their circulations, currents and tides, it could also be considered the universal carrier. Because aquatic animals and plants are surrounded by a moving medium in which practically every kind of chemical and particle is either soluble or suspendable, these organisms are inevitably brought into much closer contact with one another than are terrestrial animals, which are partly insulated by the surrounding air. It is as if each aquatic animal and plant were actually touching its neighbors, those close by at all times and those farther away intermittently. Under such conditions, it would be most surprising if aquatic organisms did not influence one another chemically, either as a by-product of waste elimination or by means of substances developed specifically for the purpose. Biologists are, in fact, finding that a kind of chemical warfare goes on continually in the sea. More and more marine plants and animals have been found to produce substances that pass into the water and eventually affect other individuals — sometimes members of their own species but more typically members of different ones.

Several years ago, Dr. Nigrelli, Pathologist of the Aquarium, predicted that scientists would eventually find all sorts of biologically active substances in sea water as well as in the creatures inhabiting it.¹ He also emphasized the impor-

tance of scientific investigations in this field because of the vital role such substances must play in the amount of food produced by the sea, because of the new types of chemicals and chemical reactions that would be revealed and, finally, because some of these would undoubtedly prove important in pharmacology, that is, as medicines, or the prototypes of medicines, for man. Dr. Nigrelli himself has discovered some potent substances of this type, the two most important being Holothurin from a sea-cucumber and Ectyonin from a sponge. The Aquarium's Department of Marine Biochemistry and Ecology, with Dr. Nigrelli as its head, was established in 1957 principally to foster studies along these lines.

Dr. Nigrelli's pioneering work on the chemical activities of animals in the sea recently culminated in a three-day conference on the "Biochemistry and Pharmacology of Compounds Derived from Marine Organisms" which was held at the Barbizon-Plaza Hotel in early April. It was Dr. Nigrelli who conceived of the meeting and he planned and organized it under the joint sponsorship of the New York Academy of Sciences, the Office of Naval Research, the American Institute of Biological Sciences and the Zoological Society. The program included 32 papers, representing the research of 48 scientists from the United States, England, France, Italy, Norway, Sweden, Israel, Australia and Japan. Noteworthy biochemical properties of a wide variety of animals were described, among them sponges, jellyfishes, worms, snails, octopuses, sea-cucumbers and fishes. Some of the substances discussed are of immediate practical concern since they are involved in the paralytic shellfish poisonings and fish poisonings suffered by man, and also in the venoms of such notorious inhabitants of the sea as the Portuguese man-of-war, the cone shells, sting rays and scorpion fishes.

The conference was the first of its kind and it served the dual purpose of focusing attention on some of the less known but most significant aspects of marine biochemistry and of indicating paths for future research. Everyone agreed that it was a great success. — JAMES W. ATZ.

¹ See "Beneficent Poison from the Sea?" in *Animal Kingdom*, Vol. 55, pp. 175-177, December, 1952.



Dr. Nigrelli exhibits the sponges from which a potent substance, Ectyonin, is obtained.

THE WATERFOWL OF THE WORLD. By Jean Delacour. Illus. in color by Peter Scott; also numerous maps in black and white. Vol. 1, 1954, 284 pp., 5 guineas (approx. \$15); Vol. 2, 1956, 232 pp., 6 guineas (approx. \$18); Vol. 3, 1959, 270 pp., 6 guineas (approx. \$18). Country Life, Ltd., London.

When Vol. 1 of this superb work appeared in 1954, it was reviewed in *Animal Kingdom* (Vol. LVIII, No. 2, p. 64). The unusual values of the combined experience and abilities of author and artist were noted and expectation was expressed that the two projected volumes to follow would reach the high standard established by the first. With the appearance of Vol. 3 this expectation has been fully realized, for both text and plates in this, as well as in Vol. 2, are as meticulously and beautifully done as those of Vol. 1. The entire list of waterfowl, from the Magpie Goose at the beginning of Vol. 1, through the swans, geese, shelducks, dabbling ducks, eiders, pochards, perching ducks, scoters, mergansers and stiff-tailed ducks to the curious Black-headed Duck of South America to bring Vol. 3 to a close, has now been completed. All that is known of behavior, distribution, plumages and taxonomy — the latter sound and supportable in spite of controversial implications — will be found here. Even care in captivity, a subject in which

both author and artist are leading experts, has been fully treated.

As originally planned, Vol. 3 was to have completed the work. Space, however, proved inadequate for all that should be said, so Vol. 4, to contain morphology, anatomy, biology, history, conservation and bibliography, is now projected. Certainly it is safe to predict that Vol. 4 will bring this fine work to completion on a level as high as that of Vol. 1. — L. S. CRANDALL.

CAGE BIRDS IN COLOR. By G. Mandahl-Barth. Illustrated by Henning Anthon. 142 pp., 157 species illustrated in color. M. Barrows & Company, Inc., New York, 1959. \$2.95.

This American edition, printed in Denmark, suffers somewhat in translation from the Danish but nevertheless is of considerable value. The text briefly but adequately describes the distribution, nesting habits and food requirements of 157 species, and includes a section on the general care of cage birds.

The illustrations of the more commonly kept species of quail, doves, lorikeets, parakeets, love birds, parrotlets, large parrots, weaver finches and canaries are excellent and unexpected in a book of such modest price. The occasional mistakes in translation detract very little from this attractive book. — G. W. MERCK.

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SPRINGTIME
IS SUCH A *GOOD TIME* TO
VISIT THE ZOO & AQUARIUM

So this Spring we're planning
4 special Saturday Morning Members' Tours!

APRIL 9
BIRDS

Curator William Conway is proud as a peacock of the Zoo's brilliant collection of water-birds. Under his guidance, you'll see Flamingos, Black-necked Swans, Eider and Golden-eye Ducks, Demoiselle Cranes, Trumpeter Swans and an amazing variety of Ducks, Geese, Herons, Storks and Ibises. Members will also visit the Jewel Room, tenanted just now by particularly lustrous Hummingbirds and Sunbirds.

APRIL 30
MAMMALS

What with the big group of Monkeys in the new Monkey House, and the four new "Little Women," and the Okapi and Hippo babies, and the burgeoning Nyala herd and the delicate Gerenuk, there'll be plenty to see on the Tour that Associate Curator of Education Herbert Knobloch leads.

MAY 14
THE AQUARIUM

The table manners of "Ookie," our young female Walrus (the only Pacific Walrus in captivity), are effective rather than polite—it's a treat to see her eat. Dr. James Atz, Associate Curator of the Aquarium, also promises Members a close look at "Yogi," the leaping Sea Lion; "Olaf," the big male Atlantic Walrus; the young seals and our varied collection of sharks and brilliant coral reef fishes. This year, Members will see for the first time the new "Tripool" (an intriguing interlacing of 3 seal pools), the colorful picnic area and the new souvenir building.

JUNE 4
CAMERA
SAFARI

A Camera Safari in the Zoo under the genial surveillance of Staff Photographer Sam Dunton is a rewarding experience. The only requirements are a camera, plenty of film and an urge to catch the perfect picture.

These Saturday Morning Tours start promptly at 10:30 a.m.—Zoo Tours from the Administration Building, the Aquarium Tour from the entrance hall at the Aquarium. Members are requested to bring no more than one guest. It's not necessary for you to inform us of your intention to attend—just come.



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ANIMAL KINGDOM



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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Gorilla—and Man

NO STUDY OF WILD ANIMALS has quite the same interest as that which leads to a better understanding of our nearest relatives in the animal hierarchy. Quite apart from the often futile discussions—endless in their pros and cons—whether man has *descended* or *ascended* from a primitive animal ancestor, the fact remains that the anthropoid apes, of all forms of animal life, are the most similar to man.

Of the four major classes of "man-like" apes—gorillas, chimpanzees, orang-utans and gibbons—the gorilla has some transcendent quality, just as the lion, more widely known, has through the long centuries of human history come to be thought of as "the King of Beasts."

Our Society, over the last half-century, has sponsored field studies of many different kinds. We feel special satisfaction in presenting, in this issue, an initial report concerning observations of gorillas in their natural habitat. This imposing and evidently highly intelligent animal has not heretofore been studied so carefully or so intimately over an extended period of time. The excellence of the initial survey made by Dr. John T. Emlen and by George Schaller, and of the current field work of the latter, who is now observing the gorilla colonies on Mt. Mikeno in the Belgian Congo, cannot be too highly commended. This work has been made possible by a grant from the National Science Foundation with supplementary funds provided by our Society. We hope that the present project may lay the groundwork for a series of studies of the primates in the years to come.

Henri Bergson, French scientist and philosopher, once remarked, "There is no intelligence without a fringe of instinct, and there is no instinct without a fringe of intelligence." Beyond doubt, both human beings and the higher forms of mammalian life have one thing in common; namely, that many of their actions are motivated by instinct. Consequently, the study of the gorilla, and indeed of any primate, can, among other values, lead us to a better understanding of ourselves.

Fairfield Osborn

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A Field Study Sponsored by
The New York Zoological Society

In the Home of the Mountain Gorilla

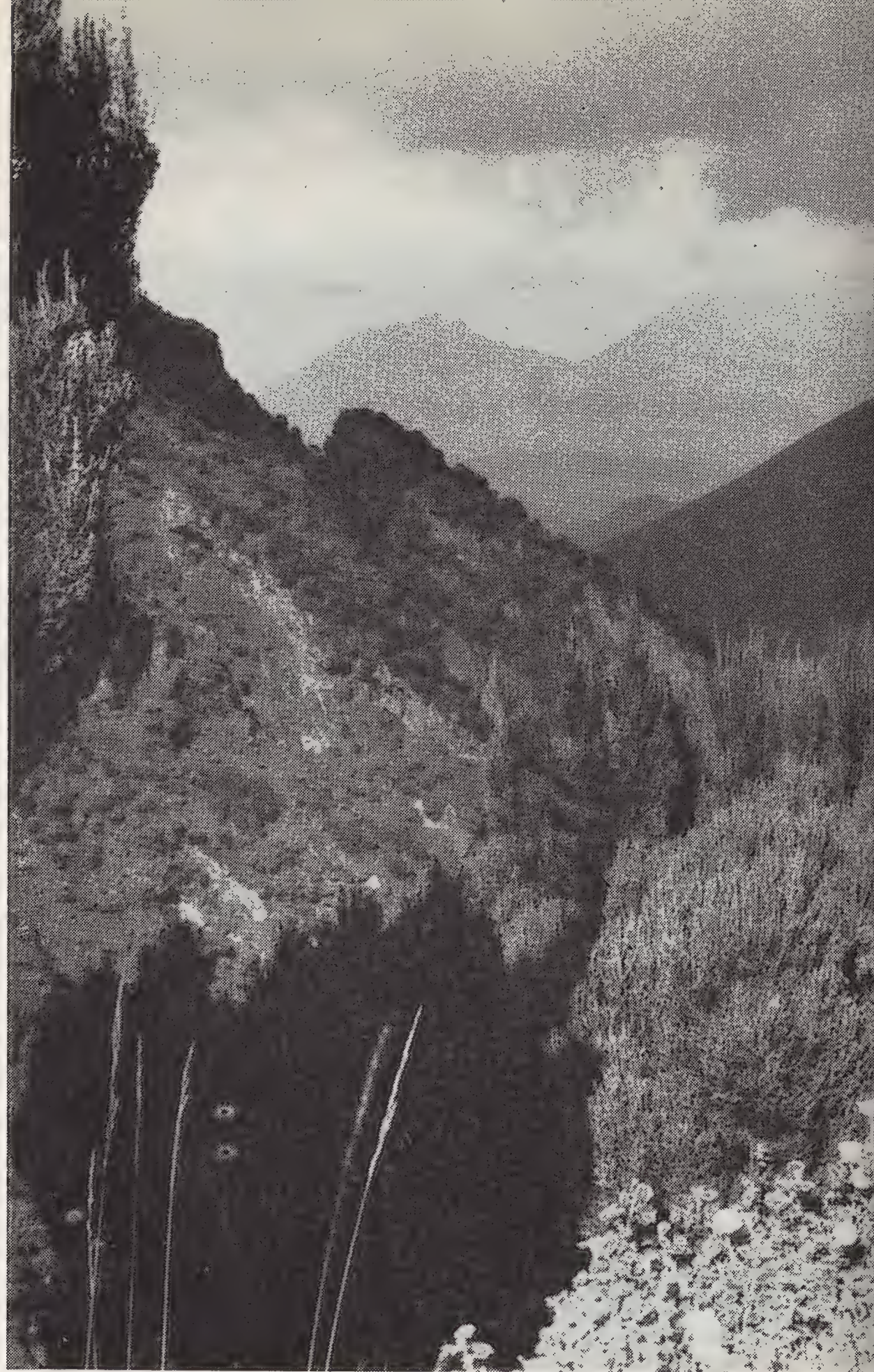
By
JOHN T. EMLÉN, JR.

Professor of Zoology, University of Wisconsin

&

GEORGE B. SCHALLER

University of Wisconsin



LEISURELY, and with frequent pauses for snacks of foliage or succulent plant stems, the troop of gorillas moved up the slope of Mount Mikeno. As the leaders swung in our direction we quietly stepped behind the trunk of a large *Hagenia* tree. Only 60 feet away, and still oblivious of our presence, they stopped again. A calm-faced female, a baby clinging to the long black hair on her back, unconcernedly took a seat in the dense weeds and began stuffing strands of bedstraw into her mouth. Farther on we could distinguish a large, gray-backed male, the dominant animal and leader of the troop. Another female sat in the sun a short distance down the slope, a baby at her side. Here we were at last, far from the hustle and bustle of noisy civilization, witnessing a peaceful scene in the family life of man's closest living relative, the magnificent and much maligned Mountain Gorilla. The dream which had inspired and plagued us

Distribution of the Mountain Gorilla in 1959. Black spots are "gorilla areas" 10 to 100 sq. mi. in size. Dots indicate stragglers; hatching marks a central region of fairly continuous but sparse population.

All photographs copyrighted by George B. Schaller and may not be reproduced without permission.



mained quiet and motionless. A closer approach would have gained us nothing, and certainly we would not now leave the scene for which we had waited so long. It was several hours before the gorillas broke the spell. Then, one by one, they left the huddle; some fed, a female basked in a patch of sun, a juvenile playfully swung back and forth on a liana only 80 feet from our hiding place. No one had ever recorded what we were now witnessing and we were overwhelmed with a strange feeling of urgency and responsibility to report every move of every animal. But it was getting late and we were ill prepared to spend the night.

Slowly we retraced our steps, selecting our route among the numerous buffalo trails as they scaled steep mountain slopes or traversed misty stands of ponderous *Hagenia* trees festooned with dripping mosses and lichens. Presently the forest

Left — The Virunga Volcanos seen from the slopes of Mt. Mikenno; the most intensive Gorilla studies are being made in the forest below the volcano. Below — Silver-backed male and part of a troop under study.

Both photos by George B. Schaller

through many months of planning and preparation had come true. The close approach and intimate observing that many had said would be impossible had been realized.

Suddenly the large female on our left saw us; her soft brown eyes hardened as she grabbed her baby and jumped back into the rank undergrowth with a short scream of alarm. There was a moment of tense alertness as all members froze in their tracks. We held our breath wondering what would happen. Then, to our relief, one face after another turned toward us in a quiet, quizzical stare; curiosity replaced alarm as the troop gradually assembled around the big male to peer intently in our direction. There they sat, craning their necks; some of the juveniles climbed into the surrounding trees to get a better view. Several times the male rose on his hind legs, beat his chest with a rapid and resonant “pok-pok-pok” and then settled back. The females and even the juveniles took their turns at chest beating too; a display which suggested some sort of general annoyance rather than fear or threat.

Except for the rapid scribbling of notes we re-



gave way to a small meadow designated on the maps as Kabare, flanked on one side by the rock face of Mount Mikenno, and on the other by the 14,500-foot cone of Mount Karasimbi. Only a few miles away to the northeast lay the rugged peak of Mount Sabinio where Captain von Beringe 56 years ago collected the first Mountain Gorilla known to science, perhaps a direct ancestor of the animals we had been watching.

A small cabin, put at our disposal through the generosity of the National Parks Institute of the Belgian Congo, was attractively situated at one edge of the meadow. Behind it and partially shaded by flowering forest trees lay a large flat stone bearing the simple inscription: CARL AKELEY—Nov-17-1926-. The famed American sculptor-naturalist who lies buried in this spectacular setting had first come to collect gorillas for the American Museum of Natural History. He had been so impressed with the “amiability and decency” of his quarry, however, that he returned in 1926 specifically to study their habits. Tragically, he died just as his work was starting; his vision, never realized, was now before us as a challenge. Akeley was right—the gorilla is not primarily a formidable foe to be feared and destroyed; it is a magnificent and peace-loving creature with much to teach us about ourselves if we will show the patience and persistence to learn. Akeley saw this; he also saw that the Mountain Gorilla, restricted to a tiny region in the heart of the vast African continent, could easily be wiped out of existence forever by the greed and carelessness of man. The beautiful Albert National Park which we at this moment were enjoying, indeed the whole system of nature reserves in this part of Africa, received an impetus from the farsighted thinking and devotion of this great conservationist and humanitarian.

Since Du Chaillu first published his rather exaggerated accounts of gorilla life in West Africa in 1863, hundreds of articles and books have been written about them. Few of the writers were concerned with obtaining or presenting information. They were, like many modern writers, sensationalists who found self-satisfaction and financial profit in exaggeration and irresponsible prevarication. Their stories have resulted in a widespread misconception of the gorilla as a



ferocious and blood-thirsty beast with an amazing array of human and even superhuman traits, all basically treacherous. Even scientifically-minded naturalists have been influenced by these accounts, and progress in obtaining basic information has been seriously handicapped by the resulting misconceptions of difficulties and dangers involved in field studies. One victim of these accounts, believing that observations could not be made without physical protection, spent many days inside a cage in the forests of West Africa waiting for gorillas to come to him. As might be expected, his success was as restricted as was he.

The first serious attempt to study gorillas in the field was made by a psychologist, Bingham, in 1929. Working in the same area selected by Akeley and subsequently by ourselves, Bingham obtained much interesting information on feeding behavior, bedding behavior and daily movements simply by following gorilla trails through the forest. He had little success with direct observation, however, possibly because of the large size of the parties of trackers, porters and gun-bearers which he felt obliged to take with him.

The important discovery that gorillas are approachable and may be quietly studied in their forest homes without fear of attack is largely due to the work of a hotel keeper at Kisoro, Uganda, and some of his scientist friends. In the past three years, Mr. Walter Baumgartel and his skillful guides have led party after party of un-



University. No less than four primatologists from the Japan Monkey Center have been to Kisoro to observe the gorillas; two of them, Dr. Kawai and Dr. Mitzuhara, spent three full months there in 1959 tracking and observing the animals through the Volcano forests and the nearby Kayonza.

These various observers not only gave encouragement that gorillas could be studied, but they also showed that the only way to obtain a full picture of gorilla ecology and behavior was to initiate a long-term project in which several troops would be observed continuously for a year or more. With the help of Dr. Harold J. Coolidge of the National Research Council, a project was set up with this objective in view. With funds provided by the National Science Founda-



Above — The Kabara hut at 10,200 ft. in the Albert Park, where Mr. and Mrs. Schaller are living. Right — Carl Akeley, who dreamed of a Gorilla sanctuary, is buried here on Kabara meadow in Albert Park.

Both photos by Kay M. Schaller

armed and unprotected hotel visitors into the mountains behind Kisoro and showed them gorillas. A massive, 500-pound male gorilla presents a terrifying spectacle as he rises to roar defiance at intruders of his forest domain, but Mr. Baumgartel reassures the timid by pointing out that actual attacks by gorillas are unknown except as responses to persistent approach, inflicted injury or precipitous retreat. Reuben, the head guide, scoffs at the thought of carrying firearms as he makes his daily forays into gorilla land to follow their movements and observe their behavior.

Scientific observations of these Kisoro gorillas started in 1957 when two young biologists, Miss Rosalie Osborn and Miss Jill Donisthorpe, were dispatched to Baumgartel's hotel by Dr. L. S. B. Leakey of the Coryndon Museum in Nairobi. Working independently, they obtained much valuable information, particularly on food habits, and made enough direct observations of behavior to thoroughly demonstrate the wealth of opportunity awaiting attention. Other visitors to Kisoro have included Professor Raymond Dart, discoverer of the South African man-apes, and Dr. Niels Bolwig, an internationally known student of animal behavior from Witwatersrand

tion and the New York Zoological Society, and sponsorship by the latter organization, we, the authors of this article, left New York with our wives on February 1, 1959, on a two-year expedition which was to prove even more rewarding than we had dared to dream.

The project was organized in two main phases. During the first six months we visited Mountain Gorillas in all parts of their geographical range to obtain information on their distribution, to get an over-all picture of their ecology, and to find the best possible sites for intensive life history studies. At this point Dr. Emlen returned to his duties in America. The remaining eighteen months are being devoted by George Schaller simply to ob-



serving gorillas, prying unobtrusively into their intimate daily lives as they raise their families and go about the business of making a living according to gorilla requirements.

During our six months of survey, we attempted to cover all parts of the Mountain Gorilla's range. This we found to be limited to the eastern portion of the Kivu Province of the Belgian Congo and to two small pockets in the southwest corner of the Kigezi District of Uganda, a perilously small area. Within it we found a wide diversity of climate and forest types from hot, low, equatorial forests at 1,600 feet to cloud-bathed thickets of giant lobelias and senecios at over 13,000 feet altitude where the temperature often drops to freezing at night.

Our first survey area was in the vicinity of Kisoro in Uganda, where Baumgartel's African guide, Reuben, and his trackers introduced us to the techniques of following gorilla spoor. They showed us where gorillas had pulled up and peeled bamboo shoots to eat the soft inner parts, and where vines had been pulled down and branches broken. We learned to recognize the knuckle imprint of the gorilla as well as the tracks of red forest duiker and buffalo.

The Kayonza (Impenetrable) Forest of Uganda was a sharp contrast to the stunted scrublands of Kisoro. From the steaming forest floor, with its smell of decaying vegetation and its foot-long

earthworms, branchless tree trunks rose a hundred or more feet into the air before spraying out into a thin, splattered canopy of foliage. Only spotty sunlight reached the ground, and the air vibrated with the incessant buzzing of cicadas. The terrain was rugged and often precipitous. Knife-like ridges dropped off sharply into deep gorges, their slopes covered with tangles of vines, brambles and sharp-spined tree ferns.

Here we had five Batwa trackers, pygmoid denizens of the forest whose principal acquisitions from English civilization were the word "yes," a quick eye for discarded tin cans and a monotonous tune vaguely resembling a Christian hymn. They were delightful companions, trotting tirelessly all day long, and every so often bursting into high leaps and loud yodels from sheer exuberance, an entertaining trait but one not altogether conducive to quiet gorilla study. If they found a bee tree all else was forgotten until the last pupa had been eaten and their gourds were packed and overflowing with sticky golden honey. On the gorilla trail we peppered them with questions through our interpreter, a young English-speaking African boy. "Do the gorillas eat this plant?" "Do they often nest in trees?" "How many animals in a troop?" Our persistent inquiries were met with silence. Finally old Bitshumu, obviously distressed, relayed to us this important information: "If you call the animal

you are seeking by name, you will never find him." In spite of our indiscretion, we did locate several fine troops of gorillas before we left the area.

After leaving the Impenetrable Forest we visited a region west of Lake Edward, the bamboo-covered mountains of the Rift escarpment, of which Tshiaberimu at 10,000 feet is the highest peak. The spring rains had arrived and we were obliged to spend many hours huddled in our leaky brush shelter or crouched on a soggy log under a tarpaulin. A bamboo forest is a miserable place to be in rainy weather; every touch brings a shower of freezing drops while the underfooting of fallen leaves and stems is unbelievably slippery. Visibility is poor through the misty air and crowded ranks of stems, and although we heard gorillas, we never saw them. From time to time

alpine grassland. It is an immense, undeveloped region with few people, and the only industries are mining and missions. It was impossible to check the whole area ourselves, so we resorted to second-hand information from miners, missionaries and especially the native residents. The sparse network of roads provides the principal means of foot travel for these forest people, and single individuals or small parties were encountered every few kilometers. Some were so shy that they dove into the brush as our car approached, but most of them greeted us cheerfully and responded to our numerous questions with much interest and eagerness. "Are there gorillas here?" we asked. "Are they on this hill?" "Are they in this direction?" We came to have a high regard for the intelligence and integrity of our informants.

Westward from the crest of the Rift, toward the towns of Walikale and Lubutu, the mountains become lower and lower, gradually giving way to rolling hills, and finally to flatlands—a tremendous area of endless forests, wide rivers

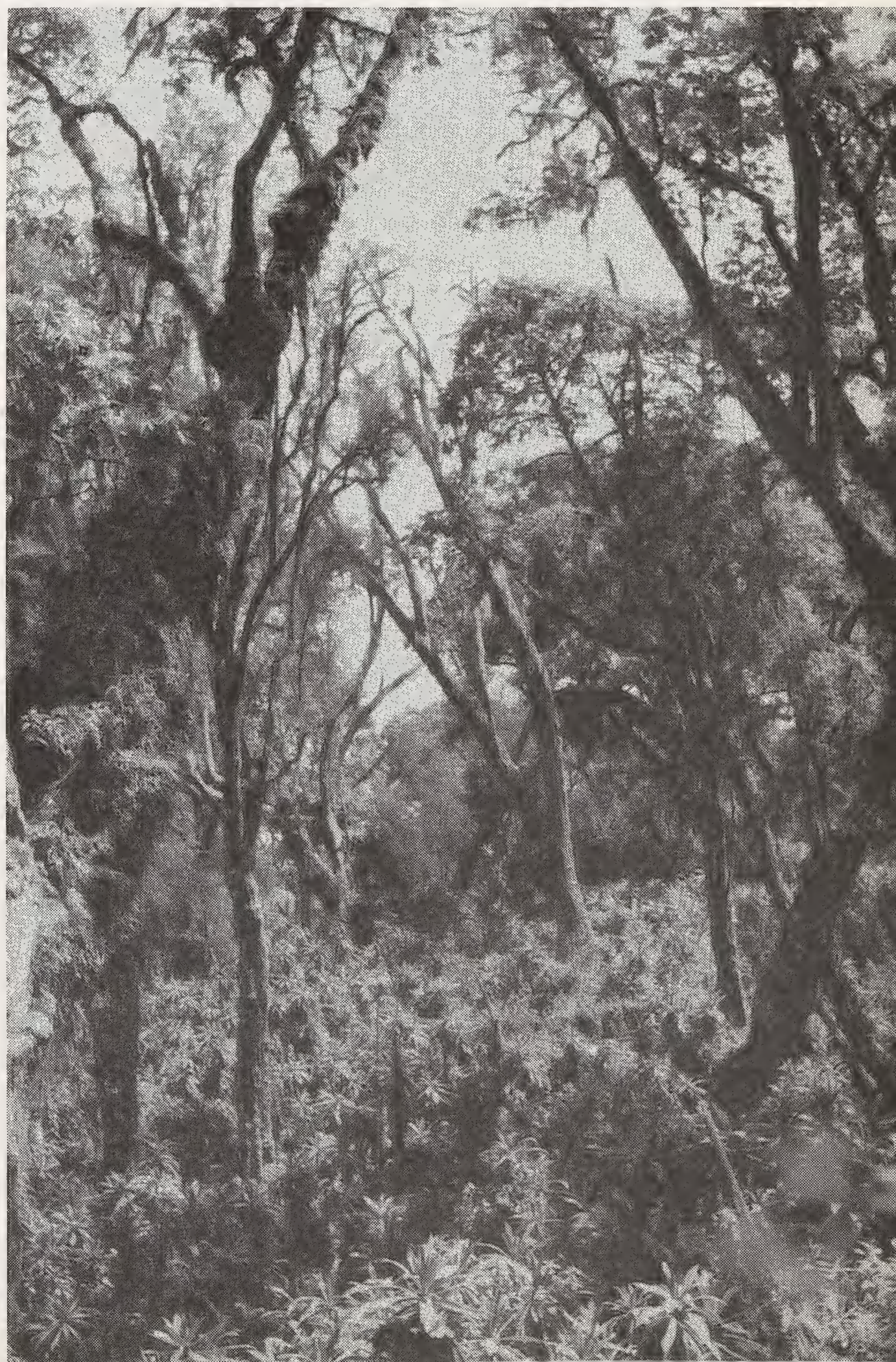
Left — Mr. Schaller writes up his notes on a cold and rainy afternoon. Right — The Hagenia forest at 10,500 ft. in the Albert Park, typical habitat of the Mountain Gorilla. Lobelias are rank ground cover.

Photos by Kay M. Schaller; George B. Schaller

the crashing of bamboo stems warned us of the unseen presence of elephants; or a sharp, distinctive odor, vividly recalling the pachyderm house back in New York, told us that these huge and fearsome creatures were close at hand. We fell into the game pits set by poachers, and once nearly tripped an elephant trap—a 200-pound log and spear slung precariously over the trail and triggered by a thin liana. After two weeks of this we were more than happy to continue our survey in other areas.

In June we headed south along the shores of Lake Kivu to the Belgian Institute of Scientific Research near Bukavu where four Mountain Gorillas were being studied in a large enclosure. Gorillas inhabit the mountains behind the station, and we investigated their nests. Traveling still southward along the base of the Rift and later along Lake Tanganyika, we checked on isolated pockets of gorillas until we reached the town of Fizi. Just to the west of town the forested mountains drop off sharply to the plains to mark the southernmost extension of gorilla range.

Driving northwestward over narrow mining roads we now entered a vast jumble of forest-covered hills, broken occasionally by expanses of



and a sparse human population. Mr. and Mrs. Charles Cordier, independent animal trappers, know the gorillas in this vast region better than anyone else mainly through their efforts to provide animals for zoos throughout Europe and America. We visited them at their home near Kabunga and enjoyed their hospitality, their excellent meals and our first sight of such rarities as the Giant Pangolin and the Congo Peacock.

Here we decided to split our efforts. While Emlen traveled along the roads and questioned people over the vast region to the west and south, Schaller, with three Africans, transected 70 miles of roadless forest on foot to check on the distribution and density of the gorilla population in the relatively undisturbed hinterland. The heat and humidity in the forest were oppressive. Silence prevailed, broken now and then by the heavy swishing wing beats of a Giant Hornbill, or the rustling commotion of a troop of Red Colobus Monkeys as they took flight high up in the forest canopy. The trail, if such it could be called, often followed creek beds where slippery bottoms and treacherous pools permitted faster progress than the vine tangles, thorns and stinging ants of the forest interior. Downpours swelled the rivers over which we transported our loads of camping gear, collecting equipment and supplies on slippery swaying logs. For the Africans the highlight of the trip came when a dead forest pig was found, soft and green and smelling terribly. Their feast lasted far into the night; George ate corned beef from a can.

A group of oil palms here and a patch of immature forest there served as reminders of a period, not long past, when the notorious Tippu Tip rounded up the inhabitants of these forests and took them to the coast as slaves, and of the times when Stanley and Livingstone visited the Arab towns on the banks of the Lualaba not far to the south. Later the Belgian government moved the remnants of these remote populations out to the roads, where they could keep track of them and bring them some of the amenities of the outside world.

Gorillas apparently benefit from man's continuing disturbance of the vegetation. There is little food for them in the shade-killed understory of the undisturbed equatorial forest, and gorillas seem to have moved out of such areas and concentrated along the roads and near the villages. The African system of agriculture, in which the forest is cut and the soil tilled for a few years and then abandoned for a period of 15 or 20 years of recovery, provides the animals with an abundance of excellent weeds, vines and young trees. It is probably for this reason that gorillas concentrate at the edge of cultivation and around mining centers where repeated cutting and clearing keep the forest from maturing.

Below — Gorillas have broken down and torn open banana stems to eat the tender pith. Right — Several Gorillas climbed a tree for a close look. Most obvious are a large male and a female and baby.

Both photos by George B. Schaller





By the end of June, 1959, our survey had been completed. Gorillas we had seen and tracked in many places and under a wide variety of conditions. Our choice of the site for the intensive behavior study had to be made, and with little hesitation we picked the cool open forests of the Birunga Mountains. The return to these forests and the undisturbed gorillas of the Albert Park was a welcome change from the ceaseless moving and tiring road travel of the survey. The impressions of approachability and observability obtained on our brief preliminary visit had filled us with high hopes for further success, but before many weeks had passed it became obvious that these impressions were only intimations of the rapport which could be achieved by long and oft repeated visits. The animals became progressively tamer and before long exchanged their wary curiosity for intimate investigation. During the past few months the members of one troop have investigated George from as close as 12 feet; they have crowded around in a semicircle,

the ones behind pushing at the ones in front to obtain a closer look; they have even climbed into the same tree with him to sit quietly though cautiously on the same branch.

After repeatedly visiting a troop under such intimate circumstances the faces and personalities of the individual members became as readily distinguishable as those of humans, and one could not refrain from giving them names. Some, like "Baby Blacktop" and "Oliver Twist" — a female with a twisted jaw — were named for special physical features; other like "Kicker" and "The Lone Stranger," received names on the basis of personality or behavior traits.

Eight different troops, totaling 132 animals, currently frequent the forest within three or four miles of our Kabara cabin. They vary in size from 5 to 25 animals. Each troop is composed of one to four adult males, several young males, two to nine females and a number of juveniles and infants.

The family relationship within a troop is very



Above — A subadult male. Below — A pot-bellied female pays close attention to her observer. Right — a whole troop, impelled by curiosity about the human being near them, close in. Big male at left is yawning.

Photos by George B. Schaller



close and quarrels are rare. During the first few months after birth, babies are carried close to their mother's breasts; later they graduate to her back and travel there until about 2½ years old. Juveniles of three or more years continue to sleep occasionally with their mothers. Both females and babies like to sit near the dominant male. He even accepts baby-sitting duties, and freely tolerates as many as four exuberant infants clambering all over him and hitching rides on his back.

Tolerance is even extended to non-members, and visiting males may join a troop for a few days without overt signs of antagonism. Gorillas do not appear to defend a definite territory. When one troop meets another they may pass each



other by, or they may join for an hour, or even bed down together for the night.

This peacefulness may be a reflection of their leisurely way of life. The dominant male apparently takes the lead in determining the course of movements and activities. It is he, also, who rallies to protect the troop in times of danger. Most of the day is spent in sleeping and feeding, and a troop usually travels less than half a mile in a day. Abundant food, in the form of vines, leaves or stems, is nearly always within reach.

The daily routine of a typical troop is fairly well set. After rising at about 6:30 in the morning, the animals immediately begin to feed. By 9:30 they are usually satiated and a long rest period begins which lasts until about 1:30 P.M.

If the sun is out the oldsters may roll on their backs and sun-bathe, while the babies wrestle and play such human games as "follow the leader" and "king of the mountain." If it rains, a common occurrence from September through December, they either seek shelter under the leaning bole of a tree, or simply sit hunched over in the downpour, with the water streaming off their long hair. After the rest period they feed again until about 5:00 P.M. when they go to bed.

A new bed is built each night. When bedding on the ground, a gorilla merely sits and bends in all the brush and weeds within reach, crossing the main stems in front of him and forming a cup-shaped structure. Occasionally no nest is made and the animal simply lies on the vegetation



or on bare soil. In the *Hagenia* forest, most nests are located on the ground because the trees do not seem to be suitable for nest construction. In the Impenetrable Forest, on the other hand, we saw nests of young animals up as high as 45 feet. In bamboo forests the majority of the nests are built of the bent-over tops of bamboo stems six to ten feet off the ground.

In order to communicate with each other gorillas employ actions, gestures, facial expressions and sounds. They, of course, lack a spoken language. A female who wishes to be groomed reaches over, taps another animal on the arm, and presents the part which she wants checked. In initiating a general troop movement, the dominant male merely leads off and the others follow, apparently without any special sound or signal. Short, harsh grunts by a male, screams by a female and whimpering by a baby all communicate certain emotions to the other members of the troop, indicating danger in the first two examples and light distress in the latter.

The security of the Mountain Gorilla is un-

Gorillas in the various troops soon come to be definite personalities to the observers. This is "Big Daddy," a large male, with part of his family staying just a little timidly behind him.

Photo by George B. Schaller

certain, especially in the light of coming independence in the Congo and Uganda, a rapidly expanding human population and changing agricultural practices. Africans in some areas hunt gorillas persistently in spite of strict government protection, but their depredations are limited by the scarcity of firearms. Isolated gorilla habitats, like the Impenetrable Forest and the Birunga Volcanos, are being encroached upon by the heavy and increasing demand for agricultural land. In the forests to the West, with their relatively low human population and resilient vegetation, gorillas appear to be holding their own. But the total area in which these magnificent animals can be found is alarmingly small, and constant vigilance must be maintained to prevent a disastrous tip of the delicate balance between security and extinction.

A BUSHMASTER IN THE ZOO AGAIN

By HERNDON G. DOWLING

Associate Curator, Reptiles

IT IS NOT THAT REPTILE CURATORS feel that they *must* do the impossible; it is merely that they would *prefer* to do so. So it is that from Ditmars to Dowling, all reptile curators at the Zoological Park have insisted on trying to keep Bushmasters. This is well known in zoo circles to be impossible. Random extracts from our own file on this species tell the discouraging story:

1938: arrived April 4, died April 7

1950: arrived March 8, died April 14

1951: arrived May 9, died May 27

1954: arrived September 13, died October 6

Any other zoological park that has been fortunate enough to exhibit the Bushmaster can compile a similar record.

With most reptiles such a frustrating history would cause the word to go out, "No further specimens of this species are desired." (All of our recent specimens have been gifts). But the Bushmaster is a very desirable feature of "the complete reptile house." Attaining a length of more than 12 feet, this snake (*Lachesis muta*) is the largest — or at least by far the longest — venomous reptile of the Western Hemisphere. Its fangs are more than 1½ inches long and are backed by an ample supply of strong hemolytic venom, so that it ranks with the King Cobra in size and the innate ability to endanger human life. In addition, the many tales (mostly false) of its tenacity and ferocity make it a snake with great popular appeal.

The Bushmaster is of considerable scientific interest, too. In some respects it is the most specialized of all the terrestrial members of its family, the Viperidae. Its vertebral column is so fragile that the use of a snake-stick or noose is inadvisable in its capture or handling. Instead,

Range of the Bushmaster extends from the lowlands of both coasts of eastern Costa Rica southward through the Amazon lowlands, with its extreme limits along the Brazilian coast in the State of Bahia. The snake likes forested areas.



knowledgeable naturalists recommend — of all things! — a butterfly net, so as to avoid all damage or shock. The formation of the tail-tip is unique in Bushmasters. The last few scale rows on the tail are modified into spines and the terminal scale is much elongated. Like most vipers it vibrates the tail when excited. Does its specialized tail-tip presage the rattle of the rattlesnake (also found only in the Western Hemisphere), or is it a parallel modification? These questions, and many others, are yet to be answered.

Captive Bushmasters do not impress one as particularly nervous snakes. They do not thrash around in their cages, rub their noses on the glass or strike at the passers-by. They merely remain in the most secluded corner, alert but unmoving. They refuse all food — frogs, birds, mice, rats, even the spiny rats from their own country. After a few weeks they become emaciated, their skin loses its gloss, and in a little while they are dead. Why should a snake die so quickly? Most snakes of their size can wait six months between feedings without showing signs of starvation. Yet most Bushmasters live less than three months.

Three possibilities have been considered: (1) the snakes are injured during capture; (2) they suffer a strong psychological shock upon capture,



and (3) conditions in captivity are too far from normal. The first possibility has been met by the butterfly-net method of capture. Certainly no snakes captured by this means have any physical injury. The relative lack of response of the captured snakes also suggests that the second consideration may not be the most important feature.

The third possibility appears to be the most reasonable. Among the various physical factors in captivity, temperature and humidity are perhaps the most important. Most reptile houses (including our own) are heated with the needs of "typical" tropical reptiles in mind and maintain a base temperature of about 80° Fahrenheit. Iguanas, crocodiles and pythons do well under such conditions. But these are all animals that regularly sun themselves and maintain a high body temperature under natural conditions. How about nocturnal animals that never, voluntarily, expose themselves to the sun? My predecessor, Dr. James A. Oliver, had considered this, too, and

The rough scales of the Bushmaster show clearly in this photograph, taken in the Trinidad forest this winter by Dr. Dowling. The local native name of the snake, mapipire z'anana, refers to the pineapple-like scalation.

had even contrived to get a Bushmaster to eat several meals by keeping it in seclusion at a temperature of 70-72° (See *Animal Kingdom*, 1957, Vol. 60, no. 6). The facilities of the Reptile House were not adequate for a prolonged test, however, and the results were inconclusive.

Recently an air-conditioner was added to the Reptile House, which gives us the possibility of lowering, and controlling, the temperature of one exhibit section. With these added facilities under construction and with such a background of interest and experimentation, it was natural that my recent trip to Trinidad was partly motivated by a desire to study the natural environment of the Bushmaster — and to bring one back, if possible.

The Bushmaster ranges over most of northern South America (including Trinidad) and in Central America as far north as Costa Rica, although throughout this region it is restricted to the mountains. In Trinidad, though reported from the Central Range in the past, it is apparently now found only in the Northern Range. Simla, the station of the Zoological Society's Department of Tropical Research, at 800 feet of altitude in the Northern Range, is about at the lower limit of the Bushmaster's range there.

The Heights of Guanapo, a relatively undisturbed montane rainforest area a few miles north of the Station, overlooks the Arima Valley from an altitude of 1,500 to 2,000 feet. Bushmasters have been reported as common there, and two were killed during my stay. February and March, when I was in Trinidad, are at the height of the dry season when temperatures attain their maxima, but the highest temperature I recorded in the forest was 75°. At night the temperature dips much lower, and between 8 and 10 P.M., when Bushmasters are said to be most active, it varied from 65° to 68°. The humidity ranged from about 70 per cent. in the daytime to 85 or higher at night. On some nights fog covered the area, giving humidity readings of over 90 per cent.

The mountains would appear to be much cooler during the rainy season, though the actual temperatures are yet to be tested. At least it is true that the mountains are often cloud-covered for days during that part of the year, which would suggest low temperatures and high humidity.

One Bushmaster was captured and I brought it back with me. It was a young specimen about 40 inches long and was found by Ram Lal, a farmer, about a mile east of the Station, while cutting the undergrowth on his cocoa plantation. The position was at an altitude of about 1,200 feet and on a west-facing, moist slope. The snake was coiled under the arum plants that formed a blanket-like ground cover about 18 inches high. The time was 3:50 P.M. — the hottest part of the day for this location. The resting place of the snake was 75° when measured, and may have been warmed somewhat by the brush having been cut from around it. It is notable that only three feet directly above this hiding place the temperature was five degrees higher (80° F.). Since

there was no cover nearby and the entire plantation had been cleared of underbrush three times during the past year, it seemed likely that this particular snake had recently moved into the plantation from the forest above. Neatly coiled in a series of tight loops, the young Bushmaster was quiescent as it was completely covered with a butterfly-net. Then it was induced to move slightly into the pocket of the net and was transferred to a snake-bag without ever showing signs of fright.

Natives of the region reported that they saw few Bushmasters in the dry season. Whereas these snakes were commonly encountered on the paths and trails during the rainy season, indicating that they were actively hunting, the only ones found during my stay were in secluded spots where they might have remained undisturbed for many weeks before the land was cleared. No hunter that I talked with could remember ever having seen a Bushmaster moving voluntarily in the daytime, nor had they ever found one on a path until after dark. However, most could remember at least one instance of Bushmasters having been dug out of the burrows of the agouti-like "lappe" (*Cuniculus paca*), some from a depth of eight feet or more.

Thus, the ecological situation under which Bushmasters live is most "un-tropical." These inhabitants of foggy montane regions emerge after dark when the temperature has dropped below 70° F. They apparently avoid sunlight and retreat to underground burrows when temperatures are too high or humidity too low. A temperature of 75° must be nearly the maximum they ever encounter in nature — and this only when foraging outside the forest during the height of the dry season. Is this true of other tropical rainforest animals? If so we zoo-keepers have a great deal more to learn about them.

It is too soon to have learned much about our new Bushmaster, but it has been given a commodious home in the air-conditioned section of the Reptile House, on the right in the main hall. Initially the temperature is being maintained at a cool 68 degrees, but this will fluctuate to match conditions in the rainforest as closely as we can. We may — indeed, we strongly hope that we will — learn how to keep and exhibit one of the New World's most exciting snakes.

ZOO NEWS IN PICTURES

Photographs by SAM DUNTON

PIGMY HIPPOPOTAMUSES have a long history in the Zoological Park — in fact, a trio that came to us in 1912 were the first ever exhibited anywhere. Their breeding record has been good and over the years four have been supplied to other zoos. However, it has been a long time since the last baby — February, 1929 — and so we were delighted when our present pair produced a 14-inch, jet-black baby (a male) on March 15. Unlike the Nile Hippopotamus born last December, the Pigmy was not born in water and at first appeared unable to swim. On its first trip out of doors, it followed its mother into a pool, struggled, and had to be rescued by a keeper. The last of our original trio died in 1952; parents of the new baby came to the Zoological Park in 1953.



Looking at the photograph at the left, of a pair of **BLACK-NECKED SWANS** nesting in the snow on March 3, it seems unlikely that the fat cygnet below could ever come from such a venture. But it did, indirectly. It was hatched in an incubator in the Bird House, from one of two eggs removed from the nest before the snow came. Eggs were removed from a later nesting and two more have hatched, so that we now have three young of these South American birds. This is the first time Black-necked Swans have nested with us, and while the hatching had to be carried through artificially, it should certainly be counted as a success for the Swans — and for the Bird House!





“This snake is not wired for sound” we said in a label affixed to the compartment of this **AFRICAN PYTHON** when she began to incubate a clutch of about 40 eggs on May 11. The wires and the instrument in the back are apparatus to measure the body heat of the snake, the heat inside the mass of eggs, and the floor and air temperatures. The African Python was not found to increase its temperature during incubation; on the other hand, a rise of about 10 degrees was found in the Indian Rock Python, similarly incubating in a nearby compartment. The temperature study is being made by Dr. Dowling and the results will be published eventually.





As we explained in the last issue of "Animal Kingdom," the four young **CHIMPANZEES** known as the "Little Women" have grown up (enough to turn an automobile tire casing inside out!) and we have acquired four more, about a year old, which have been given the same names. They are now on exhibition at the Great Apes House and keepers say they are "the nicest yet."

An unexpected but welcome birth in the collection on April 1 was that of a **STUMP-TAILED LIZARD**, apparently the first born in the New York Zoological Park. The baby was surprisingly large, fully twice the length of the mother's body cavity. From the first it was active — as active — as a Stump-tail ever is — and ate fruits and vegetables. The Stump-tail comes from Australia.



The Laughing Reptile Hunter of Tropical America

By ALEXANDER F. SKUTCH

San Isidro del General, Costa Rica

IN DIVERSE PARTS of the world, birds of various kinds are famous as snake-hunters: in Africa, the long-legged Secretary Bird; on the savannas and pampas of southern South America, the cariamas; in the vast Amazonian forests, the trumpeters. In Central America, the birds that I have most often seen carrying snakes are hawks of several species. One of the most stirring sights of the tropical forest is that of a beautiful White Hawk flying above the treetops with a long snake dangling from its talons. But the most renowned killer of snakes in the northern parts of tropical America is the Laughing Falcon.

The traveller in this region may become familiar with the unforgettable call of this hawk long before he meets the bird itself. In humid regions covered with heavy rain-forest, no less than amid the cacti and thorny scrub of arid districts, he often hears a loud, hollow, tirelessly repeated *wah-co wah-co wah-co* carrying afar from an unseen source. Some have compared this call to the agonized cry of a human being racked by insufferable pain. To me, however, it suggests, not suffering, but deep and inscrutable mystery, an impression which is strengthened by the circumstance that it is most often heard in the evening twilight, when the landscape is fading from view and familiar objects take on shadowy forms. Less frequently uttered in full daylight, this cry is well known to the country people, who in Central America call the bird "guaco" (pronounced *wáh-co*) in imitation of its notes. I had known the guaco for years before I detected the lower *ha ha ha*, like forced guttural laughter, which sometimes preludes the louder call and has earned for the bird the less appropriate name of Laughing Falcon. The imagined mirthfulness of this most staid and serious creature is responsible also

for its scientific designation of *Herpetotheres cachinnans*, the Laughing Reptile Hunter.

One most often sees the guaco perching on an exposed branch of a tree at the forest's edge, or of one standing alone in a clearing, whence it looks stolidly down at its observer. It is a stout hawk of medium size, with brown back and wings, white under plumage and a short tail broadly barred with brown and buffy white. Its big, slightly crested, whitish head is nearly encircled by a black band that covers the eyes and much of the cheeks like a mask. Rarely one will have the good fortune to see this sluggish bird fall upon a snake which it has espied amid the vegetation beneath its high lookout. I have not learned how it kills its prey, but it seems always to bite away its victim's head before flying up with it — a precaution of obvious value when the serpent is venomous. Once I watched a guaco hastily retreat when it had dropped beside a large snake whose size it had evidently underestimated. With slow, labored flight, the hawk carries its prey in its talons beneath and parallel to its body, the serpent's tail often trailing through the air behind its own.

At times the guaco breeds in holes in cliffs, but the only nest that I have seen was in a huge tree growing near the foot of a forested ridge in southern Costa Rica. A hundred feet above the ground the great trunk contained a large cavity whose wide doorway faced the steep wooded slope. Through a gap in the foliage we glimpsed a guaco resting motionless in the hollow, like a black-masked statue in a niche. From its high eyrie, the hawk looked calmly down while with long machetes we cut away bushes and small trees to give an ampler view of the nest and its surroundings.



DRE

Through this opening in the undergrowth on the hillside, I watched the eyrie from dawn until nightfall of a bright day in early March. Although my station on the steep slope was well above the base of the great tree, I was still far below the falcon's nest, and hours passed before I glimpsed the single downy nestling that tumbled about on the floor of its high nursery and was visible only when it came near the opening in its side. As far as I could see, it was everywhere light buff, except the black band around its downy head, a miniature of the mask worn by its parents. From time to time, it preened its fluffy plumage and called in a hoarse little voice for food.

All day one of the parents, apparently the mother, attended the nestling, usually resting in the chamber with it, although from time to time she flew out to perch on a branch in front of the doorway, where she stretched her limbs and preened. Not for a minute was the young guaco left unguarded. Soon after eight o'clock in the morning, the male brought the first meal of the day, a brilliant coral snake about as long as himself. Its head had already been removed, but after taking it from her mate the female bit the torn end of its body, as though to make sure that its fangs had been pulled away. Then both parents joined in a loud duet, shouting *wac wac wac* and *wah-co wah-co wah-co* in a long-drawn cry that filled all the valley and echoed from the enclosing slopes.

After the conclusion of this stirring performance, the female carried the red snake into the eyrie, but hours passed before, in the early afternoon, she began to tear pieces from the forward end while she held the body beneath her feet. Although she seemed to give bits of snake flesh to her nestling, she devoured the greater part herself, her feast lasting for nearly half an hour. Late in the afternoon, the male came for the second time that day, bringing a thick, dark-colored serpent, likewise headless. After joining her mate in the cry which seemed always to follow his return from a successful hunt, the female carried

the snake into the nest and promptly began to eat it. Her morning of fasting had engendered an appetite which it took a good part of the afternoon to satisfy. After finishing this meal, she brooded her nestling while in the gathering dusk her white breast faded from view in the dark cavity in the trunk.

My day with the guacos had proved so interesting that I decided to pass the following afternoon with them. As before, the mother divided her time between sitting in the hollow with her nestling and perching in the burío tree in front, whence she could keep a watchful eye on it. About the middle of the afternoon, while she rested quietly in this slender tree, I suddenly became aware that an animal was climbing the great tree toward the eyrie. By its uniform blackness, otter-like form, and long bushy tail, I recognized it as a Tayra, a forest-dwelling member of the weasel family, the size of a raccoon. It ascended in a direct, unhesitating manner, as though it had already detected the nest from the ground, and it climbed the thick, vertical trunk with the ease of a squirrel. Nearer and nearer the nest drew the Tayra; and still the mother guaco, standing guard in the burío tree, gave no sign that she had seen it.

Now the black animal was almost within reach of the wide doorway of the eyrie. Waiting breathlessly to discover how efficient was the unremitting guard that the hawk had been keeping over her nestling, I did nothing to alarm the invader. Only when the Tayra was on the verge of entering the hollow did the guaco bestir herself. Uttering a low, excited cry, she darted directly toward the beast; but when it snarled and showed its sharp white teeth, she dropped away without having touched it, to return to her former perch and watch it advance toward her nestling.

The situation had been so fraught with possibilities of intense and dramatic action that I, torn as always in such moments between desire to prevent a tragedy and eagerness to observe the natural course of events, had refrained from interfering. I had expected that the guaco would at least retard the Tayra's advance toward her nest. When her weak, ineffectual attack failed to delay it, I was seized with a horrifying awareness of my inadequacy to meet this emergency and save the nestling. My only recourse was to shout.

"Laughing Reptile Hunter" is a translation of the hawk's scientific name. Its "wah-co" call is often preceded by a series of ha-ha-ha notes, rather like forced, guttural laughter. It feeds upon snakes.

Drawing by Don R. Eckelberry

By this time the Tayra's head and forelimbs were in the hollow. Alarmed by my sudden loud cries, the animal, which had hitherto been unaware of my presence, withdrew its head from the hole and looked about. With repeated shouts and much waving of arms, I drove it to the ground.

Although the Tayra had been frightened by my frantic shouts, the more phlegmatic guaco, much nearer me on her perch in the top of the burío tree, was heedless of all my noise and gesticulation. Perching motionless, she uttered excited *wa's* higher in pitch than any calls that I had previously heard from her. Even after the assailant had retreated to the ground, she did not return to the nest. From her lofty perch she could see into it, as from my lower station I could not. Nor could I at once decide whether my shouts had preserved the life of the nestling guaco or had been uttered a moment too late. For a long while I watched in an agony of doubt. Had I, after long searching, found a guaco's nest only to lose it so soon?

Again and again, during the next hour, the

In the forest behind this rustic church of Rivas, in Costa Rica, is the home of the Laughing Reptile Hunter whose nest was under observation until a Tayra killed the single young.

Photo by Alexander F. Skutch

Tayra and its mate, which now appeared, began the long climb to the eyrie, to be driven back by my shouts and gesticulations, and much waving of my shirt that I had taken off. I yelled until I was hoarse. Although the uproar that I made served to keep the Tayras from the treetop, it did not drive them from the vicinity. They lurked in the neighboring undergrowth, waiting for a moment when my guard was relaxed to finish off the young guaco.

The afternoon dragged slowly on, and still the mother bird delayed on the same lofty perch, not returning to her nest after a short intermission, as she had always done in the past. With waning confidence, I kept my eyes fastened on the doorway of the eyrie, hoping to glimpse the nestling as it moved about on its high nursery's floor. But I watched in vain. It did not again show itself, as it had so often done on the preceding day. Through my field glasses, I seemed to detect the nestling's light buffy head with a black band around it, showing just above the doorsill. For over an hour it remained quite immobile, and I was forced to the melancholy conclusion that the little bird had been killed by the Tayra.

At last, as the sun sank low, the mother guaco bestirred herself, stretched her wings and spread her barred tail, then flew over to the eyrie and



picked up the nestling in her bill. It hung limp and lifeless in her grasp.

The guaco dropped the nestling and looked down at it for a minute or two. Then she began to tear the lifeless body between her feet and bill and to swallow it piece by piece. The being which she had brought into the world by weeks of patient sitting, kept warm with the heat of her own body, and guarded continuously by day and by night, had become to her, now that its vital spark was extinguished, what it actually was, a piece of lifeless carrion, a bit of organic matter whose only use was to supply a little nourishment to some creature still living. Why not to her who had given it life, rather than to the destroying Tayra, who awaited only my departure to return and claim its victim? Why should not guaco remain guaco, rather than become Tayra? Human sentiment revolts at this; but the guaco, although a dutiful parent, was evidently a thorough realist quite devoid of tender feeling.

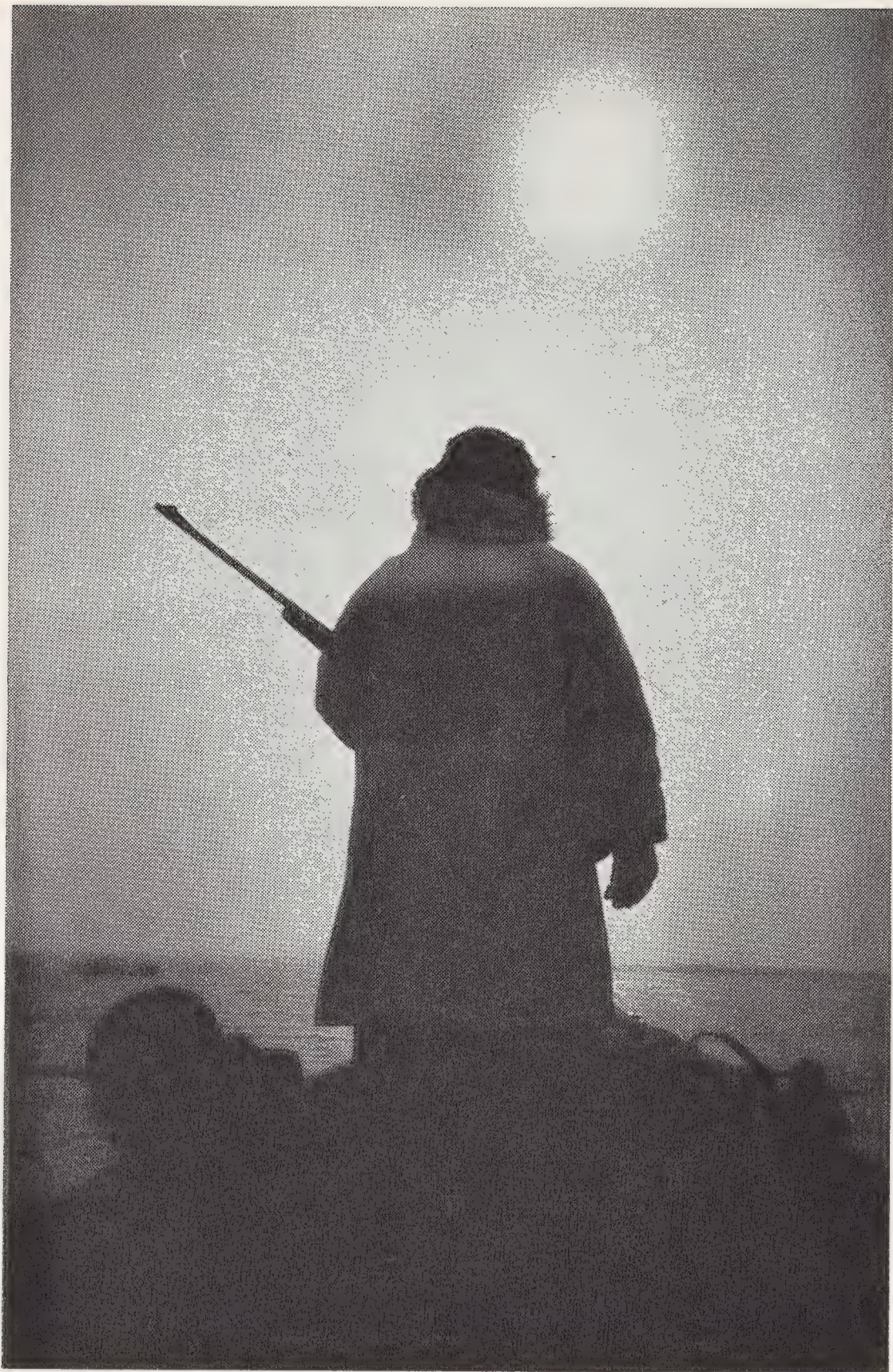
After I had reflected maturely on the matter, I could not censure the mother guaco for failing to attack the Tayra furiously as it climbed to her nest. Compared with the fiercer birds of prey such as the Peregrine and the Harpy Eagle, the guaco's talons are weak, its bill small, its wings slow. She had no weapon to confront the for-

midable jaws of the mammal; a resolute attempt to save her nestling would have resulted in the loss of both herself and her offspring. For the perpetuation of her kind, it was better that she remain alive to lay more eggs and rear more young. Self-sacrifice may have a place in the pattern of life of social animals such as ants, bees and men, and men at least may be stirred to more devoted effort for their community by the example of a noble death and may moreover care for surviving offspring of the deceased; but in solitary creatures like the guaco, such excess of parental devotion is so opposed to the preservation of the species that it must be sternly repressed by natural selection. Nevertheless, we sometimes witness such sacrifice in birds which nest alone or in pairs rather than in larger groups.

Meanwhile, the father guaco was abroad hunting a snake for his family's supper, all unaware of what had happened at the nest. Apparently he had difficulty in finding what he sought, for the light was growing dim when at last he arrived, bearing a small black snake with an abruptly slender tail. Alighting in a neighboring tree, he called quietly. His mate, continuing to swallow the remains of their offspring, answered from the eyrie. Soon she flew out, took the snake from him, and began to devour it in the fading light.

The female guaco ate little, then, leaving the snake balanced across the bough, flew back to the burío tree in front of her desolated eyrie. Her mate soon followed and came to rest on a branch not far away. Then, in the last dim light of the dead day, when all purely diurnal birds had hushed their songs and the White-throated Goatsuckers were calling below in the clearing, the pair raised their voices in full duet, and continued to shout *wah-co* at their loudest for several minutes. Their voices carried afar over the drowsing valley, seeming to proclaim that although a Tayra might kill a guaco nestling, the race of Laughing Hawks was still vigorous and strong, and would need more snakes and more for their daily nourishment. And I liked to fancy that all the small birds within hearing, snuggling their heads down into their outfluffed plumage as they composed themselves for rest, would slumber with a greater sense of security for this reassurance that the hawks who preyed upon their direst enemies had hunted successfully that day.





BACKGROUND FOR A BABY WALRUS

By CARLETON RAY

Assistant to the Director, Aquarium

*All photographs, unless otherwise credited,
by Stan Wayman, Life Magazine*

A YEAR AGO THIS SPRING, when plans for expansion of the Aquarium were taking shape, we could think of no animal more engaging than a young Pacific Walrus as a feature attraction. Olaf, our impressive Atlantic Walrus, had taught us that walrus have just about everything as exhibit animals: rarity, spectacular size, high intelligence and a way of appearing almost human in their actions. A mate for him — and a Pacific Walrus at that, for there were none of this species in captivity at the time — would fill the bill. It would also give us a chance to make a comparative study of both kinds of walrus in captivity, for these are rather poorly-known animals.

Thus it was that in mid-May of last year my wife and I met Dr. Francis H. Fay of the Arctic Health Research Center in Anchorage. We had, in person and by letter for over a year, discussed diets for a baby walrus, for we knew that the real problem facing us was not one of procurement, but of feeding during babyhood. We thought we were prepared, but there was nevertheless the

The Eskimo captain of a Walrus-hunting expedition stands lookout as the boat approaches ice where the animals are found.

A young male Walrus, of perhaps 2,000 pounds, allowed close approach. This is not uncommon if it is not frightened.

preliminary job of getting a walrus to try our theories and diet on. And so the next stage was to travel to Nome and then to the little village of Gambell on the northwest tip of St. Lawrence Island, a mere 35 miles from the Chukchi Peninsula of Siberia. From the air as we flew over the floe ice that lies in the black waters to the north and west of St. Lawrence, we could see occasional clusters of brownish dots. These were herds of walrus and we would soon be coursing our way among them in a fragile but extremely seaworthy skin boat. It was impossible to count the walrus on our short flight, but we knew that there remained only about 40,000 in the whole Bering Sea and Arctic Ocean as compared to an estimated 200,000 or more historically. This de-

crease is the result of three centuries of hunting for tusks and oil and the harvest continues to this day, now, however, chiefly for ivory alone. Happily, measures are being taken by the new state of Alaska to regulate the kill along conservation lines and perhaps the downward trend of population will be arrested.

Our choice of mid-May as the time to arrive in Alaska was not made by accident, for May is an all-important time of the year for the Eskimo. This is the walrus season, when much of the years' food for people and dogs must be gathered and stored in underground pits — the doorway to the pits often being the scapula of a whale. This is the period of all-day hunts and little sleep in good weather, and of uneasy waiting in days of squalls and storms. The Eskimo economy is, in fact, largely a walrus economy. The meat is excellent and the liver is a true delicacy, that of the baby being especially prized. The hides are used for rope and as cover for skin boats and carved ivory is the Eskimo's chief source of money.

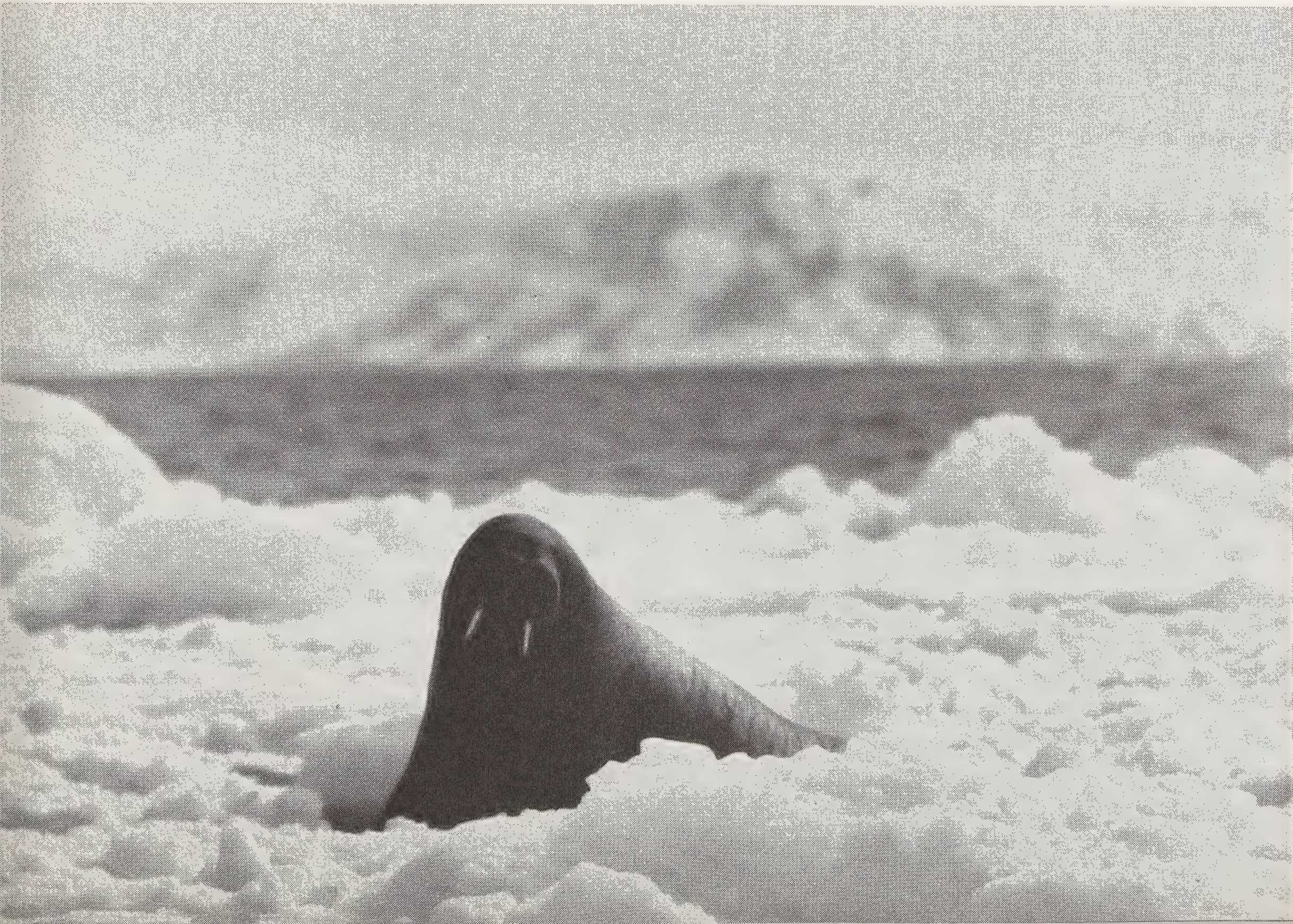
The best way — almost the only way — to capture a baby walrus is to go to sea with the Eskimos during their hunting season and to rescue a desirable baby. "Rescue" is the exact word, too. The walrus has as important a place in Eskimo folklore and beliefs as it has in their economy. The tale is told of a hunter who once brought a

live baby walrus back to his village. As time passed the hunter began to lose his speech and to "talk" in walrus-like grunts. Finally he no longer walked upright but crawled on all fours and eventually disappeared into the sea. Many Eskimo hunters still believe that if they bring back a living walrus they will be turned into one of the "walrus people." So when they encounter a female and her baby, both are invariably killed, for both utilitarian and superstitious reasons.

On this particular hunting trip, Dr. Fay and I were to accompany Winnie James, one of the Eskimo hunters, in his skin-covered boat, and if we captured a baby walrus alive, we, and not Winnie, undertook to assume the responsibility for any walrushood that might ensue. Equally important, we agreed to reimburse Winnie for the loss of the baby's meat and skin.

One of the rare crystal-clear skies broke on our first day in Gambell — there are no skies so clear and no air so pure as in the Arctic. During much of the year the Bering is a wild and turbulent sea, but Spring is its calmest and most spectacular season. It is exhilarating simply to have contact with it, and as we launched the skin boat down the gravel bank to clear water, I felt an excitement that comes, to me, peculiarly only in Alaska and on this sea.

The boat slid toward the ice floes to the west





and then through them. Among the floes, the only motion of the sea is a heaving swell of the glassy surface which grinds the floes together to produce groans and creaks from the loose pack. The ice at this time is forever moving north and the walrus move with it, as do hordes of other marine mammals and sea birds. In fact, through the northward funnel of the Bering Sea moves the greatest concentration of sea mammals and birds on the face of the earth. Here, the commonest ducks are the Harlequins, Old Squaws and Eiders, and the little Auklets buzz close to the surface literally everywhere. Over it all are flocks of majestic Little Brown Cranes. Seals of four kinds and at least five species of whales complete a spectacular panorama.

The hunting party had proceeded about fifteen miles out to sea when, without warning, a female walrus and her calf bobbed up ahead of the boat.

Carefully cutting and scraping, an Eskimo woman splits a large Walrus hide. Both pieces will be used for ropes, boats, or sold commercially.

The baby Walrus subsequently called Ookie swam up to the boat and was quickly lifted aboard, for she was just the size the Aquarium wanted.





Within a few minutes rifle and harpoon had added the female to Winnie's supply of winter meat and while he was engaged in securing her, Bud Fay and I kept our attention on the confused calf. Uncertain where to go and loathe to leave its mother, it finally heeded our call and swam directly toward our boat. We hauled the 130-pound baby aboard. A female.

Walrus calves are capable of producing a variety of sounds. This one was the most vocal we had ever heard. She grunted "Ook! Ook!" much of the time we were cruising back to Gambell. To keep her company, Bud replied "Ook! Ook!" until she fell asleep. The sound was so typical of her, and so constant, that we named her "Ookie" on the spot, and the name stuck. Within two weeks she knew her name and responded to it.

Storms and fog brought an end to the walrus season and for a time cut Gambell off from the world, but on May 31 an Alaska Airlines plane came in under low cloud and the next day we disembarked in Seattle with Ookie and a Siberian Harbor Seal—the latter a by-product of one of the hunts. Director Edward Johnson of the Woodland Park Zoo had kindly offered the facilities of his bear dens and veterinarian to the little

After Ookie was brought ashore to the Eskimo village of Gambell, she had to be moved into temporary quarters. Dr. Ray had to do most of the moving, for Ookie simply waited to be shoved.

animals for as long as it took to get them on a suitable diet. And the offer was most welcome, for Ookie had had considerable difficulty with the formula we had devised in Gambell and was down to 118 pounds.

Bud, through his considerable researches on the Pacific Walrus, had determined that walrus milk is 35% fat, 12% protein, and contains no sugar. The high fat content of marine mammal milk has long been known, but efforts to duplicate it more often than not had ended in failure, since all fats are far from alike and some may cause serious vitamin and digestive troubles if given in excess. Furthermore, an animal cannot live on fat, but must have protein. We soon decided to give no artificial oils at all.

Ed Johnson suggested that we feed clam juice and upon further consultation we decided to mix straight minced clams with heavy cream and vitamins. Heavy cream was chosen for its high natural milk-fat content and—much more important



— because of its very low sugar content. Hesitantly, but hopefully, we tried this. In the following week Ookie gained 10 pounds, and we knew the battle was won. The beginning was indeed the real battle. It was hard enough to pluck her from the sea and transport her to Seattle, but how much more difficult it was to struggle with her diet and teach her to feed from an ordinary 8-ounce baby bottle! Bottles of formula she consumed at a fantastic rate; it took just 15 seconds for her to empty a bottle, and often she sucked the plastic container flat in her eagerness.

With the invaluable aid of my wife, we saw Ookie through 10 to 12 quarts of the formula in four or five feedings every day, and now — a year later — the baby also gets a generous handful of mackerel which she neatly fillets. She has grown

Ookie is now perfectly at home in her large pool at the Aquarium, feeding ravenously and putting on weight. Tankman Charlie Young is her close friend. They “talk” together.

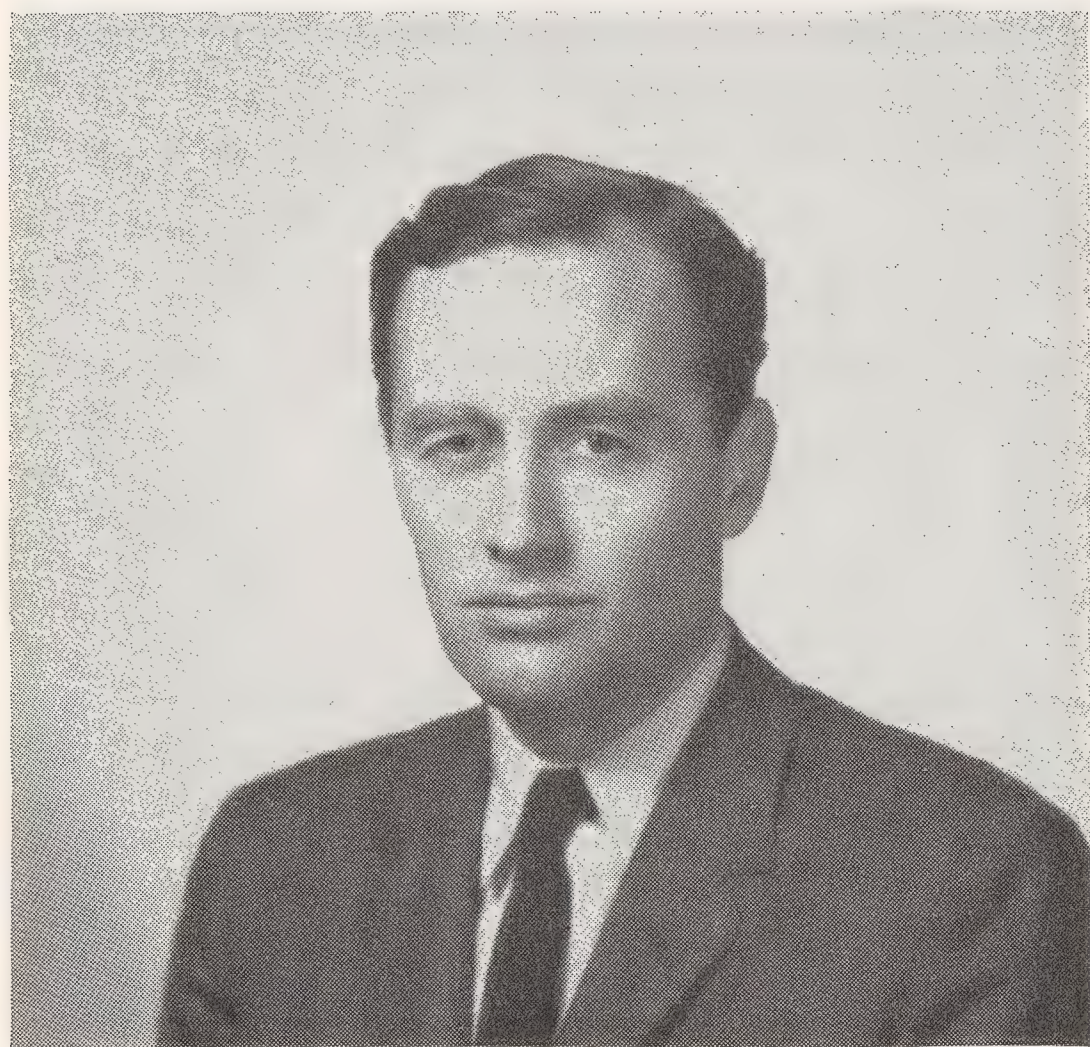
Photo by Sam Dunton

from 130 pounds at the time of her capture to 382 pounds at the latest weighing on May 16, a gain of about two-thirds of a pound a day. But that is not surprising when one considers that she has consumed more than four *tons* of food in that time.

We saw Ookie through teething and temperature and at last we feel that we have not “lucked this one through.” Details of our dietary experiences will be published, in the hope that they may contribute to more general success in the rearing of these fascinating animals.

CONSERVATION

FOUNDATION



Stephen W. Bergen

Stephen W. Bergen joined the Research Department of the Conservation Foundation in 1948. His first assignment was the exacting one of assisting Dr. H. E. Thomas in a survey of the groundwater situation in the United States, published as "The Conservation of Ground Water" by McGraw-Hill in 1951. An analysis of industrial water use followed in collaboration with The National Association of Manufacturers. This was a pioneering study of which more than 30,000 copies have been distributed.

In 1952-53 he worked with the authors of "The Flood Control Controversy," a book about the virtues of big and small dams and of land management in relation to flood problems. With Prof. David Haber of Rutgers Law School, Steve then organized a large conference on problems of water law and edited the proceedings, "Law of Water Allocation in the Eastern United States."

More recently, and as proof of his diverse talents, Steve has turned to surveys of problems in the field of chemical pesticides and worked with Dr. John L. George whose reports, "The Pesticide Problem" and "The Program to Eradicate

the Imported Fire Ant," have received wide distribution and comment.

His latest water project dealt with the design of nation-wide programs for collecting data on water supplies and water needs, "Water Facts for the Nation's Future," written by W. B. Langbein and W. G. Hoyt.

Stephen Bergen has been granted a year's leave of absence in order to accept a Littauer Fellowship at the Graduate School of Public Administration at Harvard where he will study advanced water economics and planning.

The Foundation will sorely miss him as a creative and painstaking worker.

Briefly Noted

The crisis facing African wild animal life is the subject of an article by Dr. Osborn soon to be published in *Sports Illustrated* . . . George Merck attended the 12th International Conference of the International Council for Bird Preservation in Tokyo, May 24-29, where he presented a report on species in danger of extinction . . . On April 19 Roger Hale attended a committee meeting of the Northeastern Loggers Association in Utica, New York, at which an Association conference on the small woodlot problem was planned for next fall . . . Wallace Bowman, presently in Alaska to gather preliminary data for the Alaska Recreation Study, lists among many interviews a Juneau conference with Richard Cooley of the Conservation Foundation's Alaskan Research Center, and Governor William Egan, who expressed interest and offered cooperation . . . On May 2 and 3 George E. Brewer visited the Foundation's Water Use Educational Center at Colorado College, where arrangements were made for a forthcoming teacher-training conference to be sponsored by the Joint Council on Economic Education and the Conservation Foundation . . . Stephen Bergen represented the Foundation at the Seventh National Watershed Congress in Washington, D. C., April 18-20.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Zoological Park Collection Climbs to 1,078 Species

According to the 1959 *Annual Report* of the Zoological Society, to be published in a few days, the number of species and subspecies in the collection as of census time — December 31, 1959 — was 1,078, the highest in recent years.

The census shows 192 species or subspecies of mammals, with 574 specimens; 631 of birds with 1,663 specimens; 255 of reptiles with 702 specimens. Specimens totalled 2,939.

The all-time high for the number of species was 1,290 in 1913, and in 1910 we exhibited more than 5,000 specimens. In later years a conscious effort was made to reduce the number of specimens, partly as a matter of economy and partly because it is seldom necessary to exhibit a large flock or herd in order to make an impressive showing.

According to this latest census, the New York Zoological Park is still the largest in the United States in the number of kinds of animals — the only thing that really counts.

Animal Kingdom Needed

Because of an inadvertent short delivery by the printer, plus an unusually heavy call for extra copies, the March-April, 1960, issue of *Animal Kingdom* is virtually exhausted and too few copies remain to assure the filling of library orders in the future. It would be of great service to institutions maintaining or establishing files of *Animal Kingdom* if Members of the Zoological Society who do not keep a file of the magazine would return their copies of the March-April issue to the Publications Office, The Zoological Park, New York 60, N. Y. Postage on a single copy, in an unsealed envelope, is 8 cents.

Cobras Grow Rapidly

When we hatched a clutch of King Cobra eggs in the summer of 1957, most of the babies were given away to other zoological gardens.

Only two survived; one in our own collection and one in the Staten Island Zoo. Their rate of growth has been followed with interest, and ours, the larger of the two and a male, was measured late in March and found to be 8 feet 7½ inches long. It was under two feet long at hatching.

Recently our youngster has been put on exhibition in the same compartment as its mother. She is the first live snake it has seen since its snakeling days, for while King Cobras feed on other snakes, ours are given frozen (and subsequently thawed) snakes.

The Souvenir Business

Souvenirs have come to be big business in the Zoological Park. Each of our seven souvenir stands stocks about 150 items, of astonishing variety. In years past our offerings have ranged from really excellent African wood carvings and well-modelled ceramic figurines of animals to mass produced objects made specifically for the "souvenir trade." Among the best-sellers at the present time are feather tomahawks, pearl telescopes, wooden peace pipes, hula dolls, dolls in cellophane cases, plume hats, water balls, pin-wheels, stone rings, china wall plates, magnetic dogs, Zoo pennants, pencil canes and helium-filled balloons. The year-in-and-year-out favorite continues to be the Zoo pennant, of which some 30,000 are sold every year.

IN BRIEF

Easy Expedition. Most expeditions to capture birds for the collection have to make special trips, often to great distances, to succeed. In April Mrs. Martha Bock, an employee of the Park, captured a West Indian Pea Dove on the sidewalk outside the Zoo. She noticed the bird because it was not marked like local doves and seemed to be unafraid of passers-by — so she simply bent down and picked it up. Pea Doves were at one time commonly imported, and this one was presumably

someone's pet which escaped — or was liberated in the vicinity of the Zoo.

Members' Room Again. The Members' Room in the Administration Building was for several weeks this spring given up to the needs of the Business Office while the entire second floor of the Administration Building was being remodelled. The remodelling is now complete, the business staff has moved back into bright new offices, and the Society's Members may once again enjoy the amenities of their own room.

See 'Em Up Close. As an experiment, binoculars have been mounted on the south edge of the Flamingo Enclosure and through them — at 10 cents a look — visitors may get a close-up view of the birds as they go about their daily affairs. At the moment several Flamingos appear interested in rebuilding the artificial nest mounds built on a rock-and-mud island in the pool by members of the Bird Department staff.

Takin Shower. On some of the unusually warm days in May, the Takin showed signs of distress — as it did last fall while in Rangoon awaiting air transport to the United States. A cool shower has been rigged for it inside the Antelope House and we hope this high-mountain, cold-weather animal will go through the summer in reasonable comfort. At its worst, New York weather is said to be better than a Rangoon heat wave.

Zoo Trains Again. Four special trains of the New Haven Railroad, coming from as far away as Boston, were scheduled to bring visitors to the Bronx Zoo this spring. The final one will run on June 11.

Interesting Sponge. Recently the Department of Marine Biochemistry and Ecology at the Aquarium has become interested in a small, solitary, deep-water sponge which it collected at the Lerner Marine Laboratory at Bimini, in the Bahamas. The thing that makes the sponge worthy of intensive study is that it apparently contains no ribose nucleic acid — which suggests the possibility of a new kind of cell chemistry. Dr. Ross F. Nigrelli, chairman of the department, and Dr. Martin F. Stempien, Jr., of Clare College, Cambridge, are working on the problem and a request has been made for a research grant. The sponge is *Cryptotethia crypta*.

Incubator Babies. More than three hundred eggs are being incubated in the Bird House this spring, including those of the Bronze-tailed Peacock Pheasant, Impeyan Pheasant, Magellan Goose, Ashy-headed Goose, Cape Teal, Killdeer, Falcated Teal, Demoiselle Crane, Satyr Tragoan, Crested Tinamou and a good many others of lesser importance.

PUBLICATIONS OF INTEREST

THE ARMCHAIR SCIENCE READER. Edited by Isabel S. Gordon & Sophie Sorkin. xvi + 832 pp. Simon & Schuster, New York, 1959. \$7.95.

This is a remarkable collection of eminently readable short stories, essays, poems, plays and literary fragments — all of them about science, scientists, or the impact of science on the world. Science fiction, social satire, natural history and the writings of scientists themselves are included in its broad spectrum. The Zoological Society is represented among the 135 different authors by William Beebe, Fairfield Osborn and Myron Gordon. Books like this could help counteract the growing schism between science and the *other* humanities that worries an ever increasing number of scientists and laymen. In the words of that "Newton among poets," Shelley, they absorb the knowledge of science and transform it into the blood and bone of human nature. — J. W. ARZ.

STORIES OF ZOO ANIMALS. By William Bridges. 48 detachable gummed reproductions of photographs of animals, in color, and 47 line drawings in black and white by Richard Scarry. Golden Press, N. Y., 1959. Price \$.50.

As the newest member of the very successful Golden Stamp Book series, this little book will certainly take a prominent position. From the strictly educational point of view, it seems best adapted to nine-year-olds and advanced eights, who should be able to read for themselves. But there is no restriction on its value as a boon to mothers who have children too young to read but who must still be kept occupied. Even though the factual and often amusing stories must be read to them and help be given with the engrossing problem of sticking the stamps in the proper places, much useful information will be absorbed, along with hours of quiet entertainment. — SYLVIA DUDLEY.

BENT'S LIFE HISTORIES OF NORTH AMERICAN BIRDS. Vol. I. WATER BIRDS. xxvii + 356 pp. \$5.95. Vol. II. LAND BIRDS. ix + 374 pp. \$5.95. Both volumes edited by Henry Hill Collins, Jr. Harper & Bros., New York, 1960.

The twenty volumes of Arthur Cleveland Bent's "Life Histories of North American Birds" published between 1919 and 1958 are classic reference books, some of them now difficult to obtain. For non-professional ornithologists Mr. Collins has excerpted "the best of Bent" — the descriptive and anecdotal, the "good reading" sections; he has omitted most "data on plumages, distribution, field marks, eggs, and technical details." The 1957 Check-list of the A.O.U. was used for common and scientific names, although in the text these follow Bent. Binomials are used generally, but trinomials are given where subspecies are excerpted under one species.

Each volume contains an index and a condensed bibliography. Necessarily much has been omitted, but the amateur ornithologist, if he does not know Bent in the original, will be introduced to wonderfully evocative writing. — W. BRIDGES.

HOW TO MAKE FISH MOUNTS AND OTHER FISH TROPHIES. By Edward C. Migdalski. x + 218 pp., 188 photos, 2 drawings. Ronald Press Co., New York, 1960. \$5.50.

Fishermen are truly legion and most of them would like to have trophies to remind them of their greatest triumphs and to back up their stories — but few can afford them. This book gives detailed, step-by-step instructions for making your own trophies, whether molds or casts, painted or skin-covered mounts, skulls or jaws, even silhouettes or photographs. How to set up an amateur fish museum is discussed in one chapter. This is a unique and thoroughly practical do-it-yourself volume. — J. W. ATZ.

BORN FREE: A Lioness of Two Worlds. By Joy Adamson. 221 pp., many photographs. Pantheon Books, New York, 1960. \$4.95.

The remarkable thing about Joy Adamson's account of a Lion cub she reared from a few days after birth to something more than three years of age, when it was trained and encouraged to assume a life in the wild, is not the fact that she did it — but that she manages to tell the story with a minimum of anthropomorphism. "Elsa," as Mrs. Adamson's lioness was called, behaved in the family of the Senior Game Warden of the Northern Frontier Province of Kenya in normal Lion fashion (for Lions are "family" animals, and cubs are dependent upon and cooperative with their mothers throughout their long infancy), and followed the pattern of many other cubs reared under similar circumstances. But it is a well-told story, thoroughly documented with photographs, thoroughly enjoyable. — W. BRIDGES.

New Members of the New York Zoological Society (Between March 1 and April 30, 1960)

Founder

Raymond R. Guest

Life

Charles Macdonald Grace
Royal Little
Mrs. Ferrari P. Ward

Supporting

George Baekeland
Mrs. Robert E. Burns
Mrs. Paul J. Chase
Mrs. Roy E. Larsen
Frasier W. McCann
Mrs. C. L. Miles
Miss Clara S. Peck

Contributing

Bertram D. Aaron
Mrs. Werner Abegg
Othmar H. Ammann
Mrs. Robert P. Anderson
Lars N. Boisen
Bernard D. Becker
Mrs. Elliot S. Benedict
Mrs. Esta Benisch
Mrs. Richard J. Bernhard
Walter Chandoha
Vincent A. D'Amico
Ernest B. Dane, Jr.
Julien T. Davies
Oscar A. de Lima
H. C. Dienst, Jr.
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Miss Ruth Dzervens
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Dr. Elizabeth B. Eken
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Mrs. Jules Enrich
Mrs. Rhodes W. Fairbridge
Miss Helen T. Farrell
Dr. Robert J. Faulconer
Carroll Lane Fenton
Joseph C. Fox
Mrs. Floyd E. Frankel
Miss Olive Freeman
William Lee Frost
Dr. Magnus I. Gregersen
Henry T. Heald
Edward R. Hirst
Mrs. Arthur C. Holden
Donald F. Hyde
Stewart B. Kean
Mrs. Warner W. Kent
Admiral Alan G. Kirk
E. H. Kuehn
James F. Lawrence
Mrs. Henry C. Link

John E. Lockwood
William A. Lockwood
C. Rhoades MacBride
Ross Banks Macdonald
Mrs. Ross Banks Macdonald
Rev. Laurence J. McGinley, S.J.
Henry Necarsulmer
Dr. Joseph H. O'Connell
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Willis L. M. Reese
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Oliver C. Reynolds
Mrs. Chandler Robbins, II
Charles Sabin
John D. Soutter
Miss Susan Teaney
Miss Grace Vanderhoff
Langdon Van Norden
Mrs. Thomas M. Waller
John G. Ward
Miss Fiorimonde Wedekind
Dr. W. Laurence Whittemore
Miss Augusta Williams
Mrs. Hans L. Zetterberg

Annual

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Warren S. Adams, 2nd
Mark David Adelman
Mrs. Henry C. Alexander
Ted Anderson
Mrs. Ruth P. Anspach
Mrs. Howard Apfel
George Armitage
Elting Arnold
Kent Avery
Mrs. Carl S. Badenhausen
Dr. Bertram Barall
Albert S. Bard
Miss Blanche R. Barrett
Hyman Bass
John G. Becker
Claud L. Beckham
Edward P. Beckwith
Miss Avis Berglund
David Z. Berman
Ralph C. Boarts
Mrs. Charles Brisk
Rt. Rev. Msgr. Vincent J. Brosnan
H. C. Brown
Miss Sheila Brown
R. H. Byrne, Jr.
Ralph M. Carson
Miss Margaret T. Carvin
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Frederick Kammenzind
William M. Kaplan
Dr. Gerald Kaufman
W. W. King
Lief Kittelson
Robert Koenig
H. R. Kunhardt
George Lee
Mrs. Dorothea S. Lembke

Mrs. Charles R. Leonard
Martin H. Levey
Knute Fred Lind
Richard B. Little
Walter W. Loercher
Dr. John J. Macbride
Henry M. Mahnken
Dr. J. William Maller
Harding Maloof
John Davis McNutt
Martin J. McShea
Bertram A. Meyer
A. Amasa Miller
Arthur Miller
Miss Mary Moncure Miller
James Murphy
Frank A. Mutchler, Jr.
Julius W. Oless
Homer W. Orvis
John C. Pallister
Joseph J. Pezzullo
Mrs. Anne C. Riecker
Alan Jules Roman
Mrs. Raymond Roser
Arnold I. Roth
Charles E. Russell
Arthur Samuels
John C. Schoenherr
R. Schreiber
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"Innocenta! You and your flower! When you know very well I told you to fetch my summer copy of Animal Kingdom!"

It's a little hard to tell just what arrangements this Member has made (with her poodle or with the post office?) for delivery of ANIMAL KINGDOM this summer. To make sure you get your copy, just write your summer address on a postcard and send it to the Membership Department, New York Zoological Society, New York 60, N. Y. We'll mail you the July-August issue and resume our mailings to your winter address with the September-October issue.

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ANIMAL KINGDOM



THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

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ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Animals and the Congo

THE CHAOTIC CONDITIONS in the Congo obviously represent a very sad episode in the affairs of peoples and nations. It is too much to hope that an early solution will be found. The Congo is a vast region, peopled by native races of conflicting interests, with no common language, limited trained personnel and communication systems, and with a disrupted economic system — all and all a bleak situation.

Among the many unhappy consequences is the immediate likelihood of the extermination of animals of unusual rarity, such as the gorilla, the okapi, and other species peculiar to that region. We have, within the last few days, received cabled reports of the "invasion" by Africans of the national parks, which are situated along the eastern Congo border, the supposition being that widespread slaughtering of wild animals is already taking place because these sanctuaries are no longer being protected.

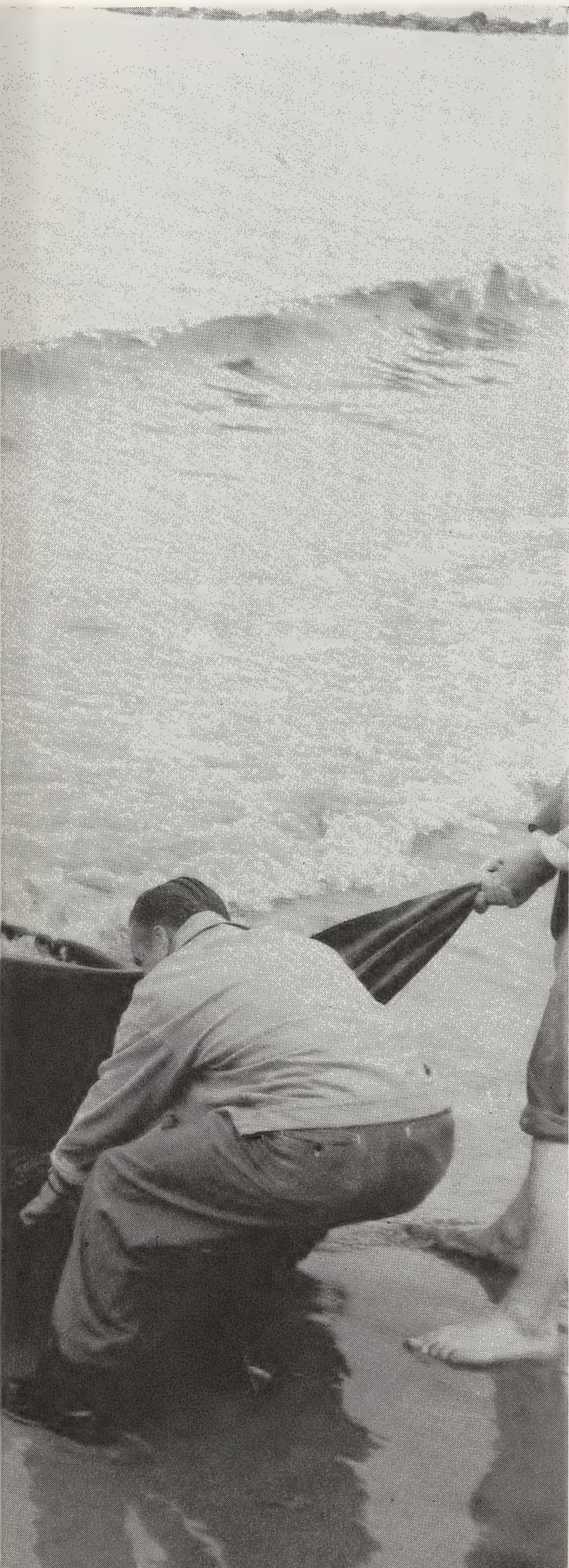
We have further received cabled requests from the President of the Parcs Nationaux du Congo Belge as well as the International Union for the Conservation of Nature, to exert any influence we can to solve this crisis. Consequently, we have submitted an official request, in the name of these organizations, as well as the New York Zoological Society, to the Secretary General of the United Nations, urging that the Congo Government, assisted by a Task Force of U.N. troops, undertake the protection of the national parks during the present situation. Of course, the re-establishment of civil order must come first and under the over-riding current pressures of political and social forces, the hope for effective action for wildlife protection is certainly not bright. However, the effort must be made because these remarkable natural heritages, viewed over the long future, are not only precious to the Congo itself but to the world as a whole.

Fairfield Osborn

A WHALE AT THE AQUARIUM



By JAMES W. ATZ Associate Curator, New York Aquarium



Its appetite for whales whetted by the Pilot Whale whose career is so graphically described by Dr. Atz in the article that follows, the Aquarium has now obtained a Beluga, or White Whale. Its photograph is on the cover.

ON THE MORNING of Friday, May 13, residents of the apartment buildings facing Brighton Beach who happened to look out of their seaward windows were treated to an unusual sight. On the beach, far above the waves of the incoming tide, lay a sizeable, black, fish-like object. A closer look at its tail revealed the pair of horizontally-placed flukes that are the unmistakable mark of a whale, and its occasional convulsive movements showed it to be alive. Some people telephoned the Police, others called the Park Department, and one schoolboy, who came upon the whale during his morning jaunt along the water's edge, ran for a telephone and got in touch with the Aquarium.

This was at eight o'clock in the morning. If we had not received the news from the schoolboy, the Police or the Park Department probably would have called us, for nearly everyone seems to expect public aquariums and whales to go together—even though the number of these animals exhibited in captivity has been exceedingly small. We still receive inquiries about the baby Beluga or White Whale that lived for only nine days in our Oceanic Tank in 1958. Indeed, the popular association of captive whales with the New York Aquarium undoubtedly goes back to 1897, when we exhibited our first, and only other, whales—two Belugas in one of the floor pools of the old building at the Battery. Needless to say, whales have long ranked near the top of the list of desiderata for our collection, and our response to the 'phone call was immediate and enthusiastic. Could it really be that a live whale

Under the direction of Dr. Ray (in the white shirt) and with the assistance of an Aquarium crew, the whale was rolled onto a large canvas for loading onto a Park beach-sled.



was waiting for us, less than a mile from our very doorstep? Would it turn out to be maimed or too severely injured? Would it be too large to move? How could it be moved, anyway? These were the questions that goaded Tankmen Charles Young and Pedro Ponciano as they drove to the scene. And they were the same questions that occurred to me when, a half hour later, I arrived at the Aquarium and was immediately informed of the exciting new development.

At the beach I found the whale attended by our Tankmen with members of the Police and Park Departments and a crowd of fascinated people looking on. A beached whale is a sobering thing to see. Its bulk makes its utter helplessness all the more pathetic. This one lay absolutely still for the most part, but its explosive, disconcertingly infrequent respiration indicated that it was alive. At irregular intervals it crooked its body with a mighty but completely ineffectual jerk that succeeded only in raising its head and tail off the ground for a second or two. From time to time it seemed to shudder, and we soon

found ourselves patting it and reassuring it, as one might a horse or other more familiar or demonstrative animal.

The whale lay on its right side nearly parallel to the beach front, and by now the leading waves of the rising tide were lapping at its back. It rested in a depression in the sand that was evidently the result of its own movements and, now, of the water's ebb and flood. After gratefully accepting the offer of a Park Department tractor and beach-sled to haul away our prize, I turned to our most immediate problem, which was to keep the whale from drowning. That whales breathe air, like every other mammal, is common knowledge, but not so generally realized is the fact that stranded whales are hardly able to move and frequently drown when the tide comes in and covers their nostrils. Our whale's single nostril or blowhole, which was located in the middle of the top of its head, was already submerged every time a larger wave advanced up the beach. One of the first things Tankman Young had done was to wash a considerable

amount of sand out of the blowhole and this had eased its breathing, but there seemed no way to keep the water out. The whale was too big for the three of us to move (subsequent measurements showed it to be 12 feet 9 inches long and nearly 1,200 pounds in weight), nor could we budge its great, bulbous head. Tankman Ponciano found a flat, softened piece of driftwood with which we were able to prop up the head a bit when the whale raised it with one of its strained, stiff-necked motions.

The arrival of Dr. Carleton Ray with an almost complete muster of the Aquarium's crew, followed shortly by the Park Department's tractor-drawn beach-sled, put an end to our worries about drowning. Under Dr. Ray's direction the whale was rolled onto a large canvas and then half lifted, half rolled up and onto the beach-sled. To all this manipulation the whale offered only a token resistance and this docile behavior appears to be characteristic of whales out of water. During the slow trip along the beach it flexed its tail now and then in a half-hearted fashion and at intervals breathed laboriously. Throughout the entire period it kept its small eyes closed.

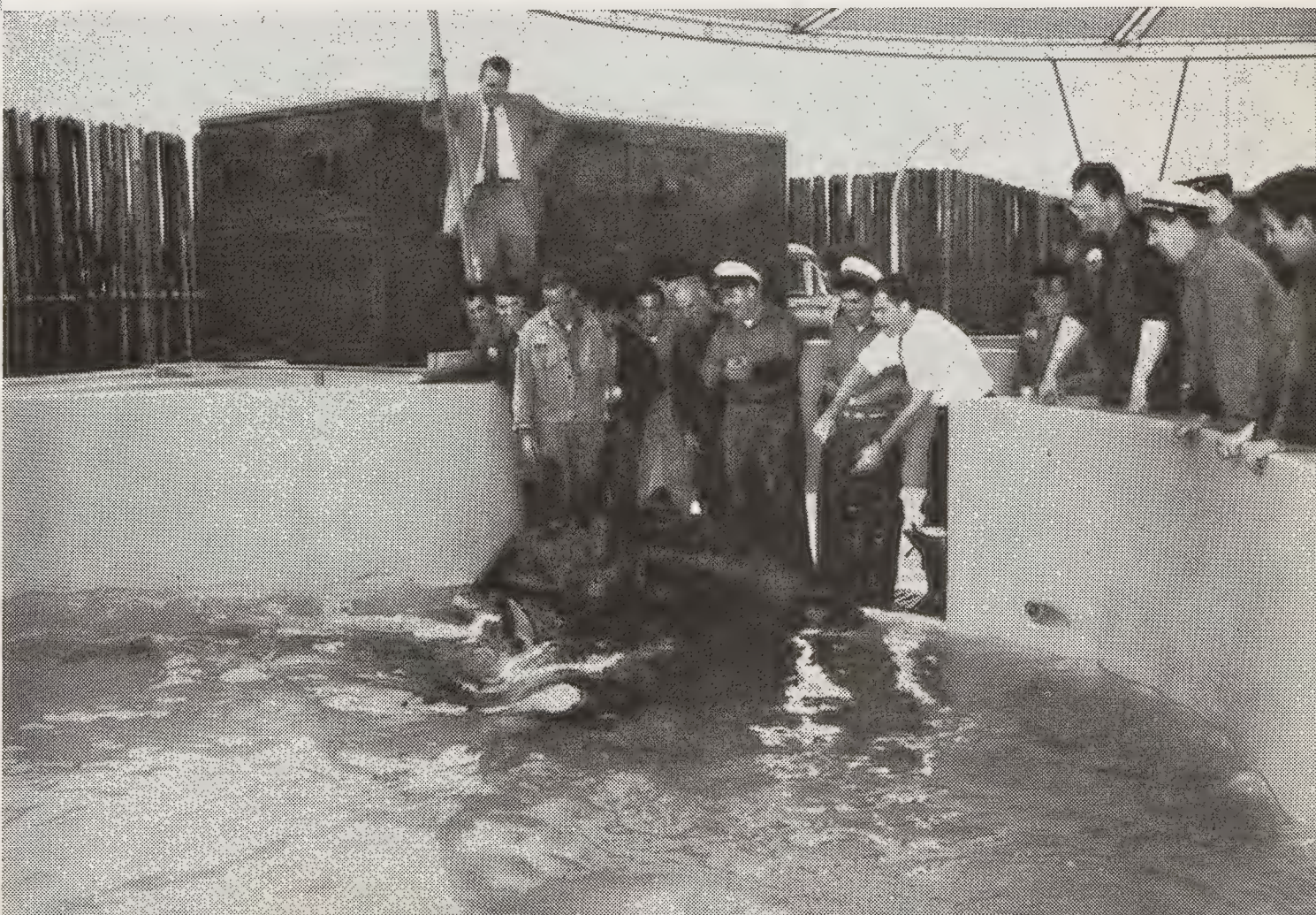
By about eleven o'clock we slid the whale into the water of one of the units of the Tripool at the Aquarium. There were a few anxious moments when it turned upside down and seemed unable to right itself, but it soon straightened up, swam into the wall of the pool two or three times and then commenced the measured, counter-clockwise circling that was to occupy practically all the rest of its life.

Our new exhibit was a North Atlantic Pilot Whale (*Globicephala melaena*), also known as Caa'ing Whale, Pothead and Blackfish. The latter name refers to its color, which is entirely black except for an irregularly shaped patch of white on the chest and belly. The enormous bulging "forehead" that overhangs the snout and constitutes the species' single most prominent feature, is responsible for the sobriquet Pothead — and the formal Latin generic name as well. The animal's well developed social habits are the reason for the common name in most general use, Pilot Whale. The species is strictly gregarious, and a large school may contain hundreds of individuals. Their schooling behavior, as a result of which those behind blindly follow those in front regardless of the consequences, has undoubtedly given rise to the erroneous idea that they follow a single leader or "pilot." Caa'ing is a Scottish term derived from "caain'," an old word meaning "rounding up" or "driving," and refers to a method of fishing made possible by the schooling reaction, in which whole schools are driven ashore by fishermen in small boats.

The limits of the geographic area inhabited by the North Atlantic Pilot Whale have yet to be worked out in detail, but Virginia appears to be its southern limit in the western Atlantic. Another species of Pilot Whale occurs to the south, apparently throughout the tropics of the world, and a third form occurs in southern



Opposite page — One of the worst parts of the job was dragging the whale actually onto the sled, for it weighed nearly 1,200 lbs. Above — Sheer manpower carried it through the doorway into one of the large pools in the Aquarium's Tripool, where it could be slid off the cloth. Right — Safely in the water, and beginning to swim. It was a moment of triumph.



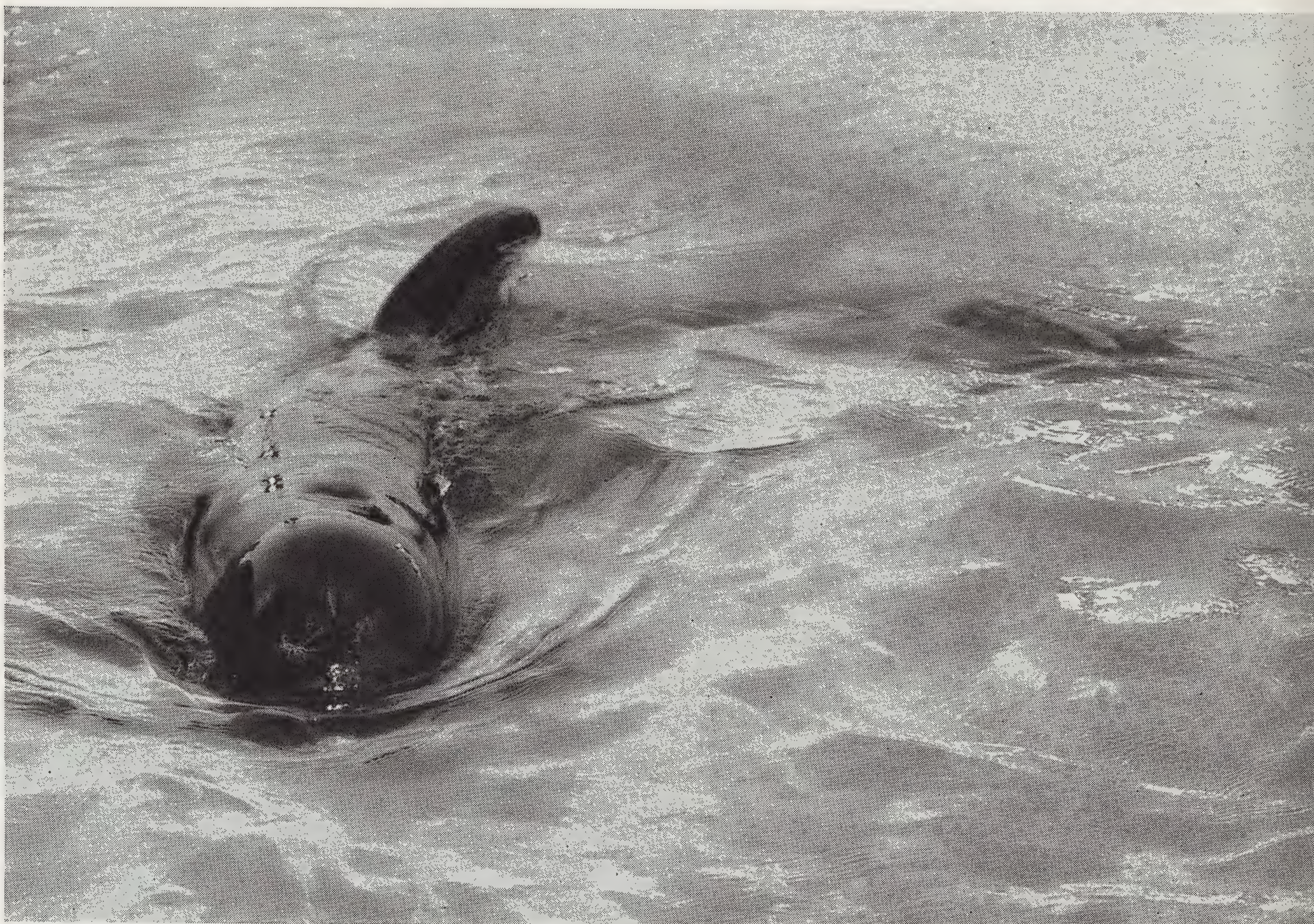
temperate seas. The North Atlantic Pilot Whale is reported to reach a maximum length of 28 feet. Females, which are smaller than males, become mature when about six years old and twelve feet long. Our twelve-foot specimen was a mature female and therefore presumably six years of age or more.

The whales of the world are divided into two major groups, the toothed whales and the whalebone whales. Instead of teeth, the latter possess several fringed plates of whalebone or baleen that hang down into the mouth and act as sieves to collect the small organisms on which these animals feed. Most of the species in the group range around 50 feet in length, with one "midget" that seldom, if ever, exceeds 20 feet. The largest animal in the world, the Blue Whale, which reaches a length of 100 feet, is a whalebone whale. The various toothed whales are equipped with two to more than 200 teeth. The 60-foot Sperm Whale belongs to this group and also included are a few species, like the pilot whales, that exceed 25 feet, but the maximum length of most toothed whales

is less than 15 feet and some are only four feet long. These smaller whales with teeth are the dolphins and porpoises. The North Atlantic Pilot Whale carries 16 to 20 conical teeth in each jaw. In nature it seems to feed exclusively on squid, but captive specimens have also been reported to consume several kinds of fish. As might be expected, the other toothed whales have similar feeding habits, but some of them also consume a variety of other kinds of invertebrates and the Killer Whale habitually preys on warm-blooded animals.

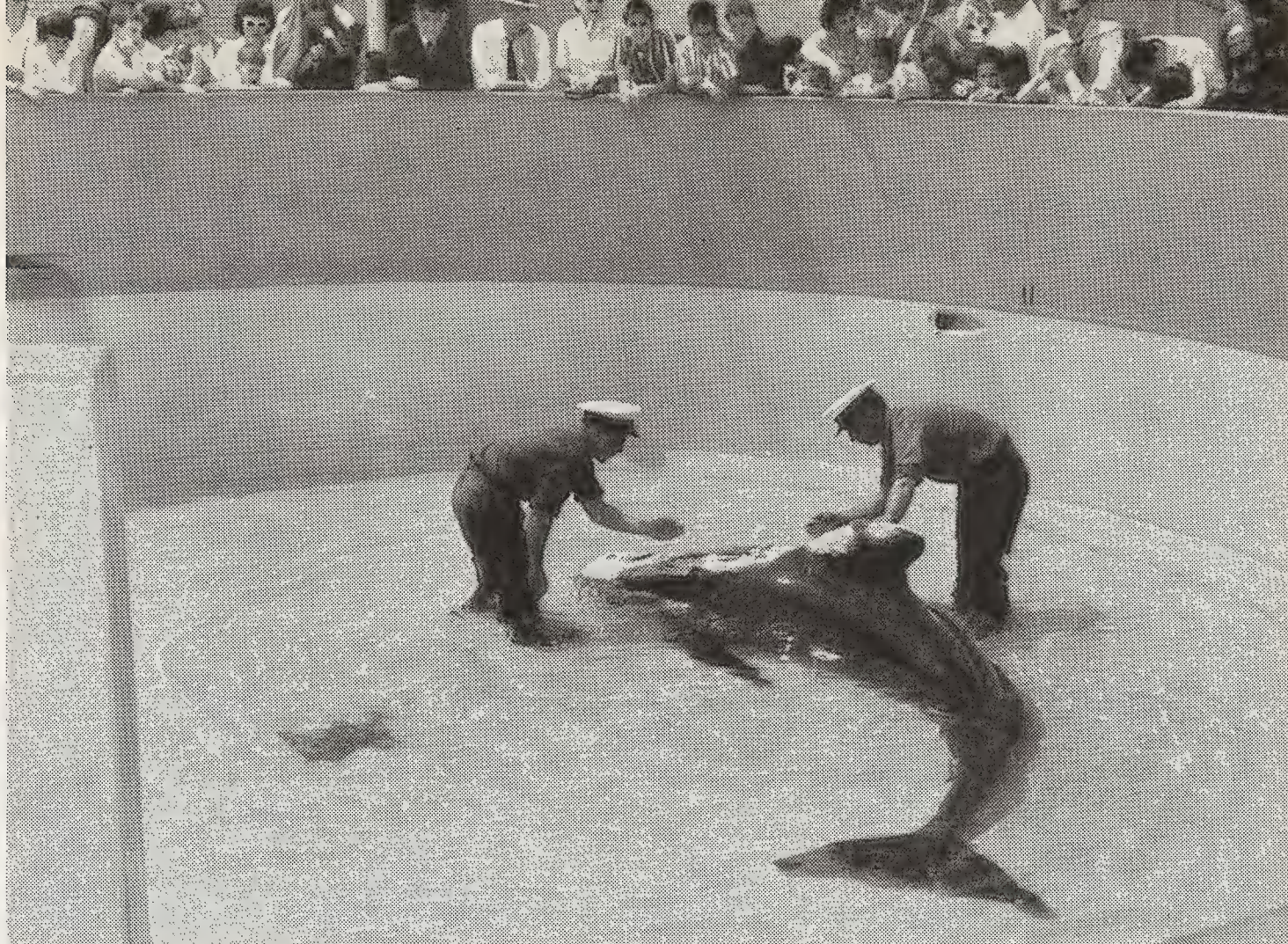
Pilot Whales are best known for their tendency to swim into shallow waters, run aground and eventually perish. Sometimes lone individuals become beached or, true to their stereotyped behavior, whole schools of 50 or more may do so. They are not by any means the only kind of

After the first few moments, when it swam into the wall of the pool several times, the whale began a measured, counter-clockwise swimming that continued almost to the very end.



Right — The water of the pool has been lowered preparatory to an attempt at feeding and attendants are splashing water on the whale to keep it cool. Below — On May 25 the canvas was slipped under the whale's body while it swam and it was dragged across the haul-out into an adjacent, larger pool.

Photo by Nat Fein, Herald Tribune



whale that gets stranded, however. At least 20 different species have been found dead or dying on the shores of England, and 14 or more in Florida. Along the coasts of our own metropolitan area, 12 species of whales, dolphins and porpoises have been recorded more or less out of water. No one knows why the animals act this way. Theories to explain the phenomenon have ranged from simple "common sense" ones — that they made the mistake of entering too-shallow water while in pursuit of prey — to metaphysical ones that declare the poor creatures have become imbued with a "death wish" and are, in effect, committing suicide. Unfortunately, there is at present hardly any more evidence for the naturalistic explanations than the speculative ones. The opinion is growing, however, that most strandings result from abnormal behavior, rather than accidents, and that the victims are already sick before they touch shore; in fact that their un-

usual behavior is the result of some pathological condition. This seems to be borne out by what happened when, in a couple of mass strandings, a few of the whales were towed out to sea: when released they promptly swam back to shore and again beached themselves. Of all the beached whales that have been obtained by aquariums and oceanariums for exhibition, only one lived more than a few weeks.

Knowing all this, we could not be very optimistic about the future of our new acquisition. Although there were no external signs of serious injury, Dr. Ross F. Nigrelli found that blood had been passed through the whale's digestive tract, which indicated some internal injury. Nevertheless, hoping against hope, we made every effort to keep her alive. After she had been in captivity for a week, Dr. Ray and two of our tankmen donned their "skin diving" suits and face masks and entered the water with the whale in order to

give her the first of a series of injections of antibiotics and vitamins whose purposes were to ward off possible incipient infection and to improve health and appetite. In the beginning the animal swam away from what were undoubtedly the first human beings she had ever seen in water, but she quieted down as soon as she was lightly grasped about the body by the divers. Giving injections to her, either in water or out, was never any problem.

On the same day we made our first attempts to induce the whale to feed. Freshly thawed market squid were thrown just in front of her snout as she swam around, but to no avail. Although there were times when she turned to look at the squid, she never attempted to touch them in any way. Because this technique had proved successful with captive Pilot Whales in other institutions we continued to try it—four times a day, nearly every day. Another technique with which David H. Brown of Marineland of the Pacific has been able to get newly captured Pilot Whales to feed is to swim underwater with the whale, get the animal to open its mouth and then put a squid into it. On three occasions Dr. Ray tried this procedure but the whale simply got rid of the food as soon as possible. Once we were able bring in some live squid from commercial pound nets off Long Island's south shore, but even this, *the* natural food, evoked no interest from our whale. We also put live fishes of various species into her pool. To be sure, we would have been surprised had she eaten any, but we felt that we could not afford to overlook a single possibility.

By the last day of May it was apparent to everyone that our whale had to be fed even if force was required. The water was drained from the pool and the whale laid on her side. While her jaws were held apart by means of a padded piece of two-by-four wood, Dr. Ray passed about 25 pounds of squid, one at a time, into her throat. Since the whale would swallow any squid that was pushed only a short distance down her throat, force-feeding was a rapid and surprisingly gentle procedure. In all, nearly 100 pounds of squid were fed in this way during four separate sessions.

Throughout this period our Pilot Whale spent her time endlessly swimming 'round and 'round. Her speed was just about 1.4 miles an hour, and

she breathed approximately once each minute. On May 25 we moved her to a larger pool, but the hoped-for change in her rigid pattern of behavior was not forthcoming. The move did, however, give us an opportunity to have Dr. Walter S. Schachat, one of New York City's leading ophthalmologists, examine the whale's eyes which had apparently been injured while she lay on the sand.

On June 7 we were surprised and pleased to find the whale showing interest in the net with which a Tankman was removing uneaten squid. It was soon clear that scratching was what she wanted. When two divers entered the pool, the whale followed them and gave definite signs of pleasure at being rubbed with a piece of netting or with just the hand. She would come to a man at the edge of the pool in order to be rubbed or scratched. But our encouragement was short-lived, for two days later our whale began to swim more and more listlessly, and two days after that, on June 11, she was dead.

A careful autopsy by Dr. Nigrelli and Dr. William Antopol, Pathologist of the Beth Israel Hospital in Manhattan, revealed that the whale was suffering from extensive lung damage of long standing, as well as liver and stomach ailments. It was reassuring to learn that none of these could be attributed to the animal's life in captivity, but much more important was the opportunity to learn something about the diseases of stranded whales. Since practically nothing has ever been written on this subject, the detailed scientific report that Drs. Nigrelli, Antopol and Ray are planning to present will be a pioneering effort. Our North Atlantic Pilot Whale's contribution to science will not end there, however. Her brain and teeth have been sent to scientists at the College of Physicians and Surgeons and her heart to Hahnemann Hospital in Philadelphia. Her skull has been deposited in the research collections of the American Museum of Natural History. But most important of all, perhaps, as far as the Aquarium is concerned, is what the whale taught both ourselves and our visitors. Thousands of people saw the whale, and for most of them it was the first living whale they had ever seen. For us, too, it was a new and memorable experience. What we learned will serve us in good stead for many whales to come.

Interlude at Simla

By MARGARET DOWLING



TO THE WEST OF THE RIDGE on which the Simla laboratory is perched runs the Arima River. Two sounds that are soon familiar to the dry-season visitor are heard from the depths of the valley each evening at 6:20: the low, slow, trill of *Bufo marinus* and the rasping bark of *Hyla maxima*. Each evening at this time the workers at the research station pause for a brief social get-together on the patio or in the lab itself. As we are talking the chorus begins, occasionally overlooked for a few minutes but always eventually noted. "Right on time tonight," someone remarks as he looks at his watch.

Hyla maxima is a delightful frog — huge and sprawling with large body, enormous popping eyes, spindly legs and preposterous feet. It is as though the frog wore swimfins, and then added

The Arima River below the Society's Tropical Research Laboratory in Trinidad is a hunting ground for reptiles and amphibians, a gentle stream with sunlit pools and lush vegetation.

a suction cup at the point of each toe. For *Hyla maxima* is a tree frog and suction cups can be very handy for climbing bamboo. Anteriorly the body is tapered, posteriorly squared-off — suggesting an adaptation for resting solidly on the trunk of a tree or a limb, but in position to leap to a safer position when threatened. And leap it can! This frog is often ten inches long with legs outstretched — and $6\frac{1}{4}$ of these are leg-inches.

Hylas sit on one's hand easily, turn their heads charmingly, but are apt to jump five feet away if disturbed. In color they are olive drab, sometimes



with a mottled yellow pattern on the sides or back and in some individuals there are pepper-spots superimposed over all. The hind legs may have pale yellow horizontal bands and underneath they are pale greenish-yellow, with the suction cups on their toes decidedly yellow-green. The females are not so dark in color as the males and more yellow dorsally; the young are very yellow indeed.

When wide awake their eyes are set on their heads like two miniature golf-balls with skin covers just over them, affording maximum visibility. The iris is gold-colored and at night is practically invisible, but in the day it contracts to form a modified diamond-shaped pupil. As if the eyes themselves were not fantastic enough, they have a bonus glamour feature, a thin spun-gold veil that can be pulled up over the eyeball when the frog is asleep or resting. This covering is a splendid camouflage for the eye — the most conspicuous feature of the Hyla's anatomy.

Among the interesting things about research stations in general is that there are always problems and questions that occur to you or are forced upon you while you are going about the solving of some quite different problem. Simla is particularly like that. Provided you are not under such pressure that you are unable to follow up any of these leads, it is a singularly satisfying experience to do so, for you sometimes turn up bits of information useful to somebody else — a fringe benefit (so to speak) of your own work. Such a fringe benefit was derived from a trip down the Arima River, wading in search of Trinidad reptiles for the Zoological Park.

We were at a pool in a deeper part of the crystal-clear stream late one morning when we noticed a large aggregation of tadpoles swimming at a depth of 18 inches near the east bank. They were not feeding, nor did they seem to be seeking either sun or shade. In appearance they were jet-black, and rather than being uniform in size they were obviously of quite different ages — ranging from less than an inch to more than two inches in length.

Our first thought was, "Here are the tads of

Closely packed aggregations of tadpoles in the stream raised the question of what they might be. Tads of the common "Marine Toad," perhaps? Some were captured for observation.

Bufo marinus." Bufo tadpoles are characteristically black, and we had certainly collected enough of the adults here at night. The closely-massed group of tadpoles seemed to stand still in the current, but when we approached they did move — upstream. Rather than scattering in all directions as most tadpoles do, the group moved in a narrow column, looking like nothing so much as the grains of sand in an hour-glass, flowing from the downstream position to another "stationary" group upstream. A few previously unnoticed individuals scuttled from beneath our feet and joined the main group, apparently glad to be "home."

In their new location, some ten or twelve feet upstream, the tads segregated themselves almost immediately into two vertically separated masses, one about six inches from the surface and the other about 18 inches below it and six inches or so from the bottom. We had never heard of tadpoles acting like a school of fishes before, and decided to make some counts of the individuals in the groups. (Numerical data are always more convincing to biologists.) One dip of the butterfly-net-turned-dip-net and 83 tads were counted from the upper group, a second dip brought up the 116 from the lower mass. The tadpoles were so closely packed that it was merely a question of sliding the net under the group and lifting. Only a single tadpole swam over the edge of the net.

On the west side of the river was another group of tadpoles of the same type. A fairly large number of these were widely scattered through the shallow water at the edge, and appeared to be feeding. A count of them gave 65. Within the margins of the scattered group and near its upstream margin was another closely packed aggregation. Again, in one dip of the net I collected all 177 individuals. This gave us a total of 441 tadpoles, in two major and two minor divisions — all in a stretch of river no larger than an average living room. Most of the tads were released after counting, but a sample of the east group was preserved for further work and a few of the others were brought back to the laboratory alive.

Each day as we went about our work of preparing and cataloguing specimens, caring for the animals already collected, photographing, arranging our field notes and pouring over maps in planning for further field work, we glanced at the aquarium and our developing tadpoles. I couldn't



This long-legged and attractive frog developed from the tadpoles — Hyla maxima, the Tree Frog whose rasping bark was so familiar to the laboratory as the nightly chorus began.

resist sticking a finger in the water to get the tads' reaction, or just to look and see if they were all under the same leaf as they were last time.

Just two weeks later one of the tadpoles had sprouted limbs and had almost lost his tail. His legs were spindly, his pupils diamond-shaped, and on his toes were tiny suction pads. They were not *Bufo marinus* tads — they were *Hyla maxima*! I'd had nothing to do with all this, of course, except to watch. But somehow I felt myself a partner in it.

We still do not know what these aggregations of tadpoles mean, though later we observed them several more times. We do know, however, that our herpetological friends who have reported tadpoles aggregated for feeding, for warmth or for metamorphosis, will be interested in this unusual, and previously unknown, social behavior of *Hyla maxima*.

OUT OF THE CONGO FOREST
COMES THE ALMOST UNKNOWN

Shelley's Eagle Owl

By JAMES P. CHAPIN

*Research Associate in African Ornithology,
American Museum of Natural History*

A FEW WEEKS AGO, during a visit to the Zoological Park, I was delighted when shown a fine live example of one of Africa's largest and rarest owls. It had come as a gift from the Zoological Society of Antwerp. For more than 45 years I had awaited an opportunity of seeing this great bird alive, whether at liberty in the rain forest of the Congo or in captivity elsewhere. So far as I can determine there are but seven skins in all the museum study collections of the world.

Yet the species was made known to science as long ago as 1872, when Messrs. Sharpe and Ussher named it *Bubo shelleyi*, in honor of Captain G. E. Shelley, a specialist in African ornithology. The first two specimens had been obtained by Governor Ussher in the Fantee district of the Gold Coast (now Ghana) in West Africa, and not until 1923 was a third example collected by George L. Bates in the forested southern Cameroon.

Ten years before that, however, it had become evident that this great owl must range very widely across the equatorial belt of rain forests in western and central Africa. Among the various puzzling feathers I gathered in 1913 from the hats worn by natives in the Ituri district of the eastern Congo was a secondary wing-quill, heavily barred with blackish, that plainly had come from a huge owl. It was about 12 inches long, and a comparison with one of the London specimens proved it had come from *Bubo shelleyi*. Thus in my

second volume on the Birds of the Belgian Congo I could include the species with certainty. But all my efforts to collect this rare bird for the American Museum of Natural History during the succeeding years have failed.

In 1926 the known range of the species was extended westward to Liberia when Dr. Georges Bouet sent the fourth known specimen to the Paris Museum from the vicinity of Monrovia. A fifth was secured by Dr. Albert I. Good in 1934 for the Cleveland (Ohio) Museum, at Sangmelima in the Cameroon. In 1952 a young bird fresh from a nest was captured by natives in the Lower Uele district of the Congo and brought to the local administrator, Mr. Bastyn, who passed it on to Brother Joseph Hutsebaut of the Mission at Buta. This owl died before it became adult, and was preserved for the Congo Museum at Tervuren, Belgium.

Still more recently a fine adult female example was collected near Yangambi on the upper Congo River by Pierre Obutobé, a man then employed by the National Agricultural Institute of the Congo, whom I had trained in taxidermy some 24 years earlier. Obutobé proudly showed me the skin in 1954, and I am informed that it has since been sent to the Brussels Museum.

Shelley's Eagle-Owl is a zoological prize, one of the rarest owls. There are only seven specimens in museums, although it was named 88 years ago. Ours came from the Antwerp Zoological Society.



Thus only seven examples of Shelley's Eagle-Owl were secured for museums over a period of 82 years. The average interval of about eleven years between captures was surprisingly great for such a large bird, albeit nocturnal, ranging for at least 2,700 miles across forested tropical Africa. It has indeed been difficult to find.

On June 30 of the present year the Belgian Colony of the Congo became an independent nation, the Republic of Congo. For many months the conservationists of many lands have wondered what effect this political change might have on the future of game protection in general and the national parks in particular. No effort is being spared to convince the new government of the Congo of the economic value of the big mammals, both as an attraction for tourists and as a reserve supply of food if managed wisely.

Some of the waterfowl and the big bustards of Africa will need the same enlightened management, but the large birds living in the dense equatorial forests are less apt to suffer from hunting. It is true that the Congo Peacock (*Afropavo congensis*) has been protected by law during the past twenty years; but recently it has seemed to be holding its own, and in the great Upper Congo forest it is known to occupy many favored situations, not densely populated by man, extending some 600 miles from east to west and perhaps 400 miles from north to south. A single feather of this bird I took also from a native hat in 1913, and a couple of live Congo Peacocks have been exhibited in the Bronx Zoo during the past eleven years. They were collected by Charles Cordier.

Now Mr. Cordier has scored another "first," with Shelley's Eagle-Owl. In September, 1958, he wrote me from his camp near Kabunga in the eastern Congo that he had been rearing a young *Bubo shelleyi*. He kept it for more than 14 months, and meanwhile sent me a couple of feathers it had shed to confirm the identification. One was a dark-colored inner secondary, the other a breast-feather boldly barred with black and white. Such feathers are readily distinguished from those of the lighter, grayer *Bubo lacteus*, Verreaux's Eagle-Owl, which ranges widely over the more open countries of Africa, avoiding the rain forests near the equator.

A little later Cordier visited the Zoo at Stanley-

ville and there found two more Shelley's Owls, which he was able to acquire in exchange for a Congo Peacock. Thus toward the end of 1959 he was proud to include three live *Bubo shelleyi* in a shipment bound for the Zoological Society of Antwerp. Of this I was informed by letter.

To the Antwerp Zoo I have paid occasional visits ever since 1909, and its friendly Director, Dr. Walter Van den bergh, responded most generously to my letter remarking on the rarity of these big owls. He made a gift of one of them to the New York Zoological Society. While wishing it long life in Bronx Park, he stipulated that if it should die, its mortal remains are to be delivered to the American Museum of Natural History for preservation.

As indicated by the photographs, Shelley's Eagle-Owl is contrastingly colored, boldly barred with black and white on the breast, mostly brownish-black on back, the crown also dark, with a patch of white in the middle, and with blackish ear-tufts. The iris is dark brown, the facial disc finely barred and outlined with black. The bird can stand about 17 inches high on its perch, and the tail is relatively short, only about nine inches long.

Nothing is yet known of the way of life of this elusive forest owl. No doubt it does its hunting at night, and from the great size and strength of its feet and claws I should suspect that it preys largely on mammals, very possibly on the tree-hyraxes that are also abroad on the boughs at night. Even small monkeys might be killed by such a powerful owl.

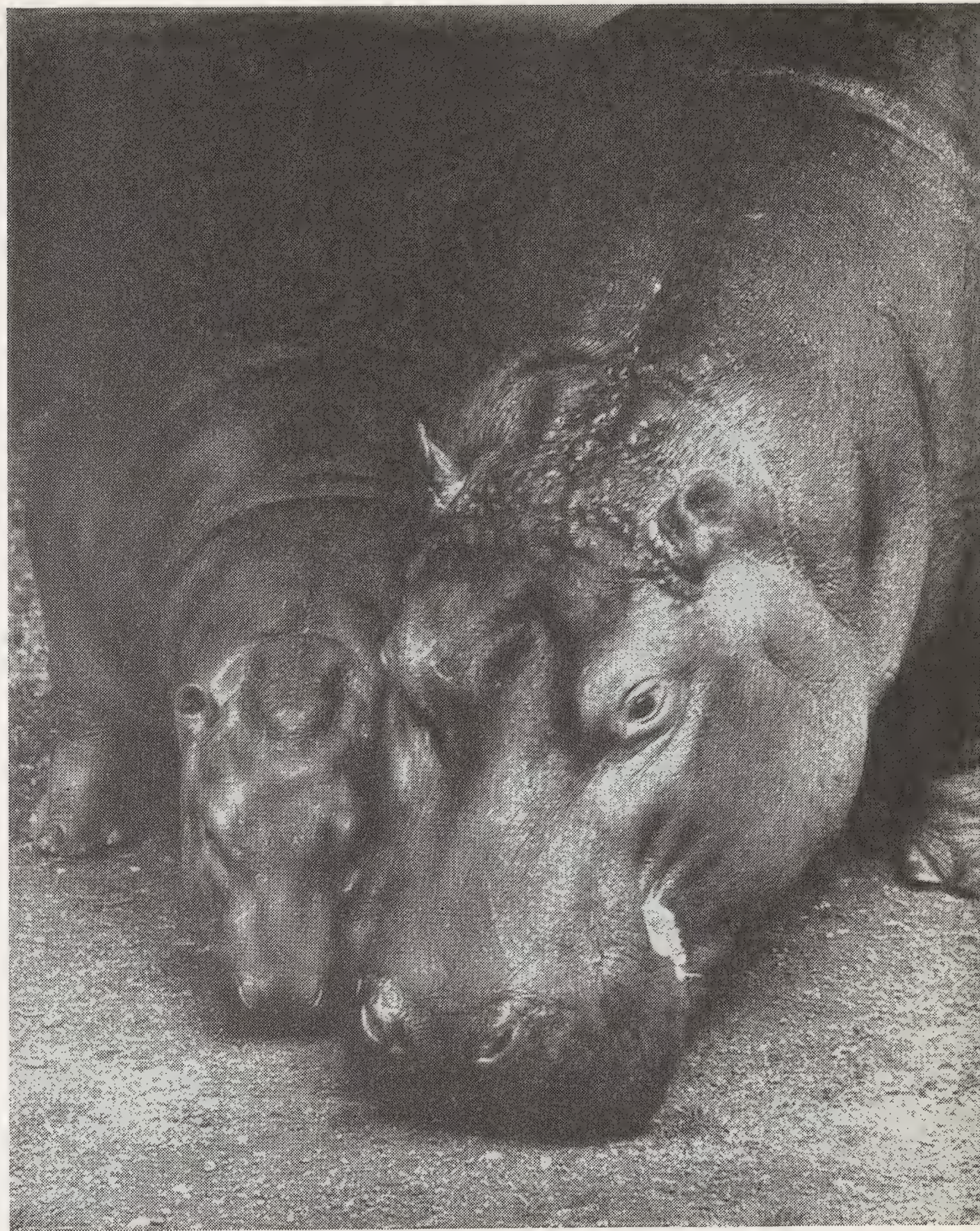
I am informed that the specimen in the Bronx Zoo takes readily to strips of raw horsemeat and freshly-killed white rats, eating about a quarter of a pound every day or two. The only sounds its keeper has heard it make is a low, querulous peep-peep-peep, continued for as long as five minutes at times when he is working in the vicinity of the bird and it evidently feels disturbed by his presence.

With regard to its nesting one can only speculate. Hollows in trees large enough to accommodate it while incubating would be rather scarce, and I should think that perhaps even more often it would use some large stick nest, high above the ground, abandoned by eagles or other large birds.

ZOO NEWS IN PICTURES

Unless otherwise credited all
photographs by SAM DUNTON

"Like mother, like daughter" might be the title of this study of Phoebe and her offspring, made on Members' Day by Mrs. M. William Levy, one of our Members. Chin-resting is a natural gesture by such a heavy animal as a Hippopotamus, and the baby adopted it very early in life. Born on December 16, the baby—a female—is healthy and sturdy and growing rapidly. But it is still very much a baby, spending most of its time with its mother in the corral.



Probably the friskiest of the spring crop of babies in the Zoo is the Siberian Ibex kid born on June 19. We were especially pleased since it was the first of the species born in the Zoo since 1942. Mountain Sheep Hill, its home, is steep and rocky but the kid is extremely sure-footed, able to keep up with its mother wherever she goes, trotting docilely by her side and stopping when she stops.

The Common Hog-nosed Snake is celebrated for its habit of feigning death when threatened but few of those that come into the collection will demonstrate the trait — perhaps because they easily become accustomed to human beings and handling. An exception was this specimen which went into its “act” repeatedly and at the slightest provocation. First it rears, spreads its neck into a kind of hood, and hisses. If this fails to intimidate an intruder, it goes limp, its tongue protrudes and it writhes onto its back. Now apparently “dead,” it may be picked up and handled, even hung on a log, without “coming to life.” Turned right-side-up, it flops onto its back again. If the intruder goes away, the snake will return to its normal “living” position in a very few minutes.



These excellent studies of some of the inmates of the Aquarium were made by an amateur photographer, Miss Emmy Haas, of New York City, and illustrate the advisability of studying the subject carefully before taking the picture. In contrast to many amateur photographers, Miss Haas may spend half a day watching her subjects before taking a single photograph. The Penguins are Humboldts, swimming in a lazy pattern around their pool. The Harbor Seal has a pliable stick in its mouth — which was soon removed by tankmen to prevent the animal swallowing it. Olaf, displaying his 5-inch tusks below, is the Aquarium's big Atlantic Walrus, still gentle despite his bulk. He is beginning to use the tusks for climbing onto the floating platform in the Oceanic Pool.





Excellent success has been achieved in hatching the 45 eggs laid by our African Rock Python on May 11. Abandoned by the female, the eggs were artificially incubated and on July 11 41 snakelings emerged, each about 18 inches long. Incubation was probably about two weeks longer than normal on account of the coolness of the cage before the clutch was removed and put into warmer surroundings elsewhere.



The Bird Department for fifty years has been seeking to exhibit one of the strangest and rarest of the Toucans — the Curl-crested Aracari — but always without success until recently, when they were suddenly obtainable as imports from South America. Now we have three lovely specimens. The curls on the head are glossy and black; the body feathers are somber red and blue.



These three young opossums are four months old and about the size of a rat. At this stage they lead a solitary life. If at any time the Virginia Opossum can be called attractive, it is at this brief period of babyhood. Open mouth and display of teeth are characteristic of 'possums.

Photo by Carlita Nesslinger Georgia

OUR ONLY MARSUPIAL

By

WILLIAM J. HAMILTON, JR.

Professor of Zoology,

Cornell University

WALKING TO MY LABORATORY one bright February morning, I came upon the familiar tracks of an opossum. A light fall of snow the previous night held the distinctive prints. These paralleled my path for a half mile, to finally disappear in an open culvert. The following morning the telltale tracks of a smaller individual appeared below my feeding station, where *Didelphis virginianus* had gleaned the scant fare of scattered cracked corn, sunflower seeds and bits of suet loosened from the holder above by jays. It is mildly exciting to read the sign of these nocturnal visitors, whether revealed by snow, mud or dust, and even better to realize that we have this quaint creature abroad in the northern winter, when so many other animals sleep away the colder months or migrate to a more temperate latitude.

Australia is the homeland of a vast assemblage of pouched animals, from the giant kangaroos to

the Pygmy Opossums, scarcely larger than a mouse. Americans are best acquainted with these bizarre beasts through visits to the zoo. Marsupials were not, however, first discovered in the continent down under. Vincente Pinzón, one of Christopher Columbus's captains, in an adventurous tour of Brazil in 1500, captured a female opossum with pouch young and presented it to Ferdinand and Isabella of Spain, who expressed great astonishment at this strange creature.

The discovery and exploration of Australia gave rise to wonderment and controversy when the continent's mammalian fauna was revealed. In time, the habits, behavior and distribution of Australia's marsupial fauna became tolerably

When Dr. Richard Harlan published his "Fauna Americana" in 1825, he related that the opossum captures its prey by cunning and not by chase. The prehensile tail, he said, enabled the beast to suspend itself from the limbs of trees and fall on the unsuspecting prey that ventured beneath. Actually, while the tail may occasionally be used as a fifth hand, it is seldom thus employed. Indeed, while the 'possum is an expert climber, and may take refuge well above ground when pursued by a dog, its natural haunt is Mother Earth. Here it spends the greater part of its life, foraging in the litter for food or safely ensconced in some safe recess to while away the day.



well known, and strange facts, many peculiar to these pouched creatures, have been documented. None, however, lead a life any more remarkable than our own opossum. Widespread and increasing its range yearly, the Virginia Opossum has long been the subject of legend and fantastic folklore. Let us briefly explore the habits of this beast, and some of the facets of its life cycle which have given rise to so much fable.

In appearance, the opossum looks like no other mammal in our fauna. Seton refers to it as a coarse-haired, grayish-white animal, with a white face and "dark-socketed eyes, like holes burnt in a blanket." Other distinctive features are the large, leather-like, black ears, tipped with white, and the long, naked tail. Large males may weigh 11 pounds, but the majority are considerably smaller.

In preparing its snug winter den, the opossum gathers leaves in its mouth for passing under its body by the forefeet. Then the hind feet pack them into the coiled tail for transport.

Drawing by Leon L. Pray, Journal of Mammalogy

Brush piles, hollow logs, stopped-up culverts and natural shelters all provide a lair for the opossum. In the north a favored den site is a woodchuck burrow. Track a 'possum in the February snow and the chances are good that the trail will lead to a deserted groundhog den. In this snug retreat a large mass of dry leaves and grasses affords a warm nest, where the 'possum slumbers through the daylight hours. Material for the subterranean bed is collected in a singular fashion. Grasping a half dozen loose leaves in its mouth, the 'possum passes the nest material back under its arched body with the aid of the fore feet. The

leaves are pushed and packed with the aid of the hind feet into the coiled tail which is held beneath the body. Occasionally the jaws will hold an additional packet of leaves. The animal then moves off to the den, where the bedding is deposited.

Like the raccoon and skunk, the opossum is no hibernator. To be sure, it may become dormant for a short period, but it seldom sleeps through a month or more of the severest weather as the skunk and 'coon are prone to do. Possibly hunger forces it abroad during the cold mid-winter nights. Then freezing spells leave their mark. In the northern limit of its range, the naked ears and tail of the 'possum are often injured. The frostbitten tips of these members often slough off, and a good percentage of the adult population is mutilated in this respect. Such injury appears to have little effect on the animal.

"Playing 'possum" is not peculiar to the opossum; it is a trait of many creatures, and death feigning is well known to herpetologists who have had anything to do with the Hog-nosed Snake, but it is the death-feigning of *Didelphis* that has brought into popular parlance the term "playing 'possum."

Many opossums have been kept for study for long periods of time in our outdoor laboratory, but strangely enough they have never exhibited this trait. Only once, to be sure, I removed a live opossum from a box trap in my yard. Thinking to keep it for a few days, I released it in a good-sized fruit cellar. Unceremoniously dumped on the floor, it did live up to its reputation. It curled in a ball, exhibiting a cataleptic behavior, exposed the lips and the formidable canines and closed its eyes. A slight prod with my shoe elicited no response, but following a bit of shaking it "came to life."

What engenders this passive life, the almost anesthetic behavior of the opossum, others of its tribe, and many other animals? Dr. Carl G. Hartman, embryologist and famed student of the opossum, believes the reaction is mediated by the nervous system and is a result of changes in the brain and ventral ganglia. He states "One is tempted to assume that in the nerve centers there are certain labile substances which are harmless in themselves but which serve as precursors to substances that paralyze. The stimulus of a touch

or a beam of light causes nerve impulses which act as percussion caps to set off the charge. The resultant new substances so stimulate the motor nerve fibers that the muscles, all of them, on both sides of the joints, contract, causing the stiffening of the limbs. After a time, the paralyzed animal recovers, as a result, perhaps of the diffusion of the paralyzing substances out of the nerve cells or their destruction by enzymes . . ." Who can provide a better answer to such behavior?

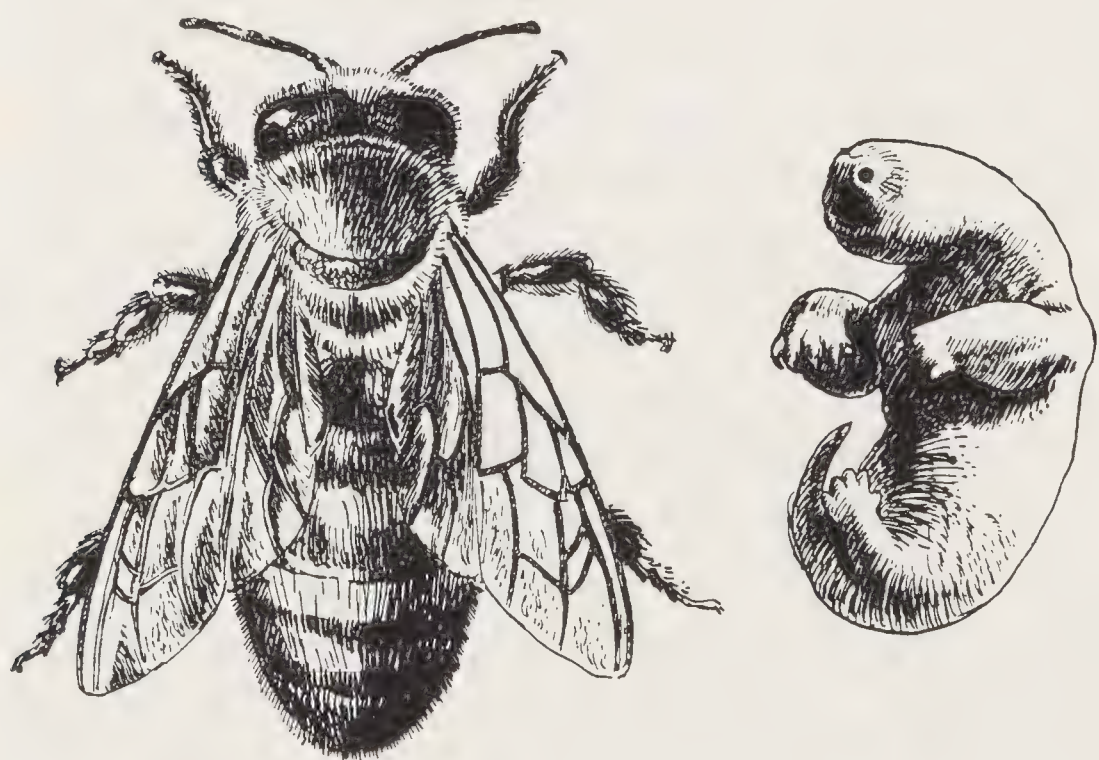
The opossum has often been labeled a scavenger, feeding as it occasionally does on garbage and offal. Perhaps this notion has been fostered by its frequent appearance about human habitations. To be sure, it will utilize food discarded by man, yet its diet differs little from that of other predatory mammals. Availability usually dictates what items are eaten, and since typical foods are seasonal the menu is a varied one. Winter snow and frost restrict its choice, yet the spring runs remain open in the coldest weather and the 'possum scratches earthworms and grubs from beneath the damp vegetation that border these wet areas. Field mice, available throughout the year, are a staple food. With the approach of warm weather it garners berries and fruits. Most of these are low-growing species, or those that are found among the dense grasses. Young rabbits are removed from their fur-lined nests, and frogs and salamanders are eaten avidly. While the toad possesses prominent poison glands that will make a dog quite sick, the opossum appears immune to the venom and astonishingly large numbers of *Bufo* are eaten. Ground-nesting birds and their eggs or nestlings, also fall victims to the opossum's appetite.

The birth and pouch life of the opossum has excited much curiosity, not only among the laity but among scientists as well. A great deal of myth has shrouded the actual course of reproductive events. Perhaps the most bizarre story is that the fruits of conception are passed into the nostril of the female by the bifurcated penis of the male, the youngsters later to be blown into the pouch. Actually, the opossum's manner of reproduction is quite similar to that of other native mammals. The exceptions have produced the fables that persist to this day.

In most mammals the fertilized egg, after a

period of growth, becomes attached to the wall of the uterus. The highly vascularized placenta anchors the growing embryo, and through this organ the capillaries of the mother and embryo establish a nutritive and respiratory bridge. No placenta is found in the opossum. One may liken her uterus to a tennis ball cut in two and filled with a loose mass of tissue paper. Each embryo is in intimate contact with the wrinkled folds of the uterus. The developing young is thus nourished by this close contact.

Uterine life is short, the young being born as "living abortions" after a remarkably short gestation of about thirteen days. This brief period is in contrast to the 63-day gestation of the skunk. At birth, baby opossums are scarcely larger than a bluebottle fly, but in one respect are well equipped for the journey to the pouch. To all appearances the tiny gob of pink flesh appears to be embryonic, for the circular mouth and budding hind limbs are unlike those of other new-born mammals. Close scrutiny will show one remarkable adaptation. The stout forelimbs are well muscled and provided with sharp, hawk-like claws. These are the tools that make possible the natal journey to the pouch, for the tiny creatures are given no help in this initial sojourn. Through the forest of hairs they make their unerring way to the pouch lip, crawl in and fasten to a nipple. These are usually 13 in number, although there may be less and occasionally more. Arranged in horseshoe shape, with the open end directed to the pouch opening, they will be pro-



A newborn opossum is not as large as a honey-bee. The hind legs appear embryonic, but the large and muscular forelimbs have sharp claws, used in climbing into the pouch.

vided with bed and board for three months. The prolific opossum often bears 20 or more young, so that late arrivals, reaching the pouch after the nipples are occupied, are doomed.

The young cling so tenaciously to the nipple that early naturalists believed the tongue grew to it, that it actually extended into the stomach of the tiny baby, the milk being pumped into the offspring. The teat does become greatly elongated by traction of the youngster, and the nipple tip indeed becomes slightly enlarged. Only by gentle and persistent traction can the young be separated by hand. Actually the nipple of the opossum functions like that of other mammals. The strong facial muscles of the young are quite sufficient to force milk from the teat.

Two months will pass before the young attain the size of white mice, the hairs assume the distinctive pattern of the adult and the young release the nipple for a short period. Almost a month more will pass before they are independent of the female, and even then they respond to her clicking call, scrambling onto her back or staying close by her side.

By this time many females have again mated, and with the weaning of the young and rapid regression of the nipple size, the mother is again ready for maternal duties. Two litters are not uncommon. In New York State, one can find pouch young from early February until late October, although individuals from our southern and western states appear to have a somewhat shorter breeding season.

The fur of the opossum is not of the best quality and does not wear too well, although it is rather attractive when made into a jacket. Even in years of high fur prices, trappers seldom realize a dollar for the finest northern pelt. With the current decline in prices for all long-haired furs, the opossum pelt is well nigh worthless and does not repay the effort of skinning and stretching the hide. In the 1940s, with prices averaging a dollar for a large prime pelt, the tremendous numbers taken gave the opossum some ranking in the fur industry. Its chief enemy today is not the trapper but rather the speeding traffic of our highways. The automobile takes a sizeable toll of the slow moving 'possum, but even this new threat will not materially reduce the population. Opossums are here to stay.

Second Smallest Bird in the World

VERVAIN HUMMINGBIRD

By OLIVER GRISWOLD

*Coordinator of Radio, Television and
Film Dept., University of Miami*

The Vervain is not brilliantly colored, as so many of the hummingbirds are, but it is perky and compels attention because of its size — a mere 1/10-inch more than the smallest bird.

THE SMALLEST BIRD ever exhibited in the New York Zoological Park's Jewel Room was the most difficult hummingbird I have ever attempted to collect. Almost unbelievable as a bird, it is smaller than many insects. With a resounding buzz of its wings, it darts in and out of flowers like a large bee. But when it alights, resemblance to an insect is gone. This charming bit of warm-blooded life is pert and personable. Swift and wily and therefore hard to catch, all of our specimens adjusted to captivity immediately. They quickly indicated they found human company not only attractive but definitely amusing, and they sang us many a song in response to our attention.

Ornithologists know this little gray, greenish and whitish hummingbird as the Vervain and by the scientific name of *Mellisuga minima*. It occurs only on two islands of the Caribbean, Jamaica and Hispaniola. In Haiti, the French-speaking natives call it "Sucé-Fleurs." In the Dominican Republic, it is "Zumbadorcito," which translates as "Little Hummer." In the British West Indian island of Jamaica it is the "Little Doctor Bird" or more often, "Little Bee Hummingbird." The Jamaicans speak of it with a special note of affection, admiration and awe, as when speaking of fairies to a child.

I find the same tendency in myself, for this gaily-buzzing sprite dwells in a land where by comparison all other birds are giants. The Vervain is two and three-quarters inches long. A claw measures a tenth of an inch. The eggs are .28 of an inch long. There is, indeed, only one smaller bird in the world — Helena's Hummingbird of Cuba, a mere tenth of an inch smaller than the Vervain.

The name Vervain is known only to a few in



Jamaica and I was at a loss to understand why Dr. James Bond had used that name in his *Field Guide to Birds of the West Indies*. Then Bernard Lewis, Director of the Jamaica Institute, referred me to Philip Henry Gosse's *The Birds of Jamaica*, published in 1847.

In the unhurried style of the good naturalists of that day, Gosse wrote:

"I have ventured to give the present species a new appellation, derived from its habit of buzzing over the low herbacious plants of pastures which our other species do not. The West Indian vervain (*Stachytarpheta*) is one of the most common weeds in neglected pastures, shooting up everywhere its slender columns, set around with blue flowers, to the height of a foot.

"About these our little hummingbird is abundant during the summer months, probing the azure blossoms a few inches from the ground. It visits the spikes in succession, flitting from one to another, exactly in the manner of the honeybee, and with the same industry and application."

My experiences with Vervains took place at Strawberry Hill, about 3,000 feet above Kingston. And here, just as Gosse had indicated, my wife and I found the Vervains partial to blue flowers of several kinds in the garden embellishing the top of the strawberry-shaped nob. We noted, too, that they appeared much tamer than other species of hummingbirds; that is, one could approach them much closer. For safety they relied on their speed and small size, easily darting into the shrubbery and the safety of interlaced twigs at the last second.

In preparation for our University of Miami science television programs, I had already collected sufficient live Streamer-tail and Mango Hummingbirds, Black-faced and Yellow-faced Grassquits, Blue Quits and Banana-quits. But the Vervains stumped me. Mist nets are ineffectual for such tiny birds, to which the finest mesh obtainable is like a barn door. Bird lime, the diabolically sticky substance smeared on the hummingbird's perching twigs, worked for the heavier species. Their weight pressed their feet into it, and they stuck. But the Vervains had virtually no weight.

Moreover, we had not only grown fond of the Vervains that enhanced the garden, but had also learned of a nest nearby with young. Male and

female are so alike that we feared we might catch the mother if we trapped in our own garden.

So we took to distant places at higher altitude and by long and patient working finally developed a bird lime mix that was strong enough, yet responded to the elfin touch of the Vervains' feet.

With several Vervains in cages, we discovered we could definitely discern the slight difference in sex coloration. We immediately released all females. The males take no part in incubation or rearing young.

Our Vervains learned easily to drink their liquid diet from the feeding bottles and quickly lost their timidity. In this our experience contrasted with Gosse's. He wrote:

"We caught several . . . but could make nothing of them; they were indomitably timid. When

The downy nestling of the Vervain in its nest. Its eyes are not yet open, and its stubby bill has not yet assumed the needle-like proportions suitable for searching flowers for small insects and nectar.

Photo by Oliver Griswold

turned into the room, they shot away to the loftiest angle of the ceiling, and there hovered motionless, or sometimes slowly turning as if on a pivot, their wings all the time vibrating with such extraordinary velocity as to be visible only as a semicircular film on each side.

"The fact that the extent of vibration reached 180° (or so nearly that it seemed to me such) shows the immense power of the small muscles by which the wings are put in motion. Neither of our other species approaches the rapidity or the extent of this oscillation; and hence with this bird alone does the sound produced by the vibration of the wings acquire the sharpness of an insect's hum. The noise produced by the hovering of *Polytmus* (Streamer-tail Hummingbird) is a whirring exactly like that of a wheel put into rapid revolution by machinery; that of the Vervain is a hum, like that of a large bee."

Our three specimens were extremely merry. They were with us only a short time when they began to sing. Other species produce what might be considered song, though usually a bit off-key and squeaky, but the Vervain's is undeniable. Early in the morning, from a high twig the Vervain vigorously warbles a soft and lovely melody. With slender beak open and throat quivering, this



atom of a singer seems to put his soul enthusiastically into telling the world his jubilation.

Our three lively specimens were, I felt, probably the smallest birds I would ever see. Then Major and Mrs. T. J. Hallinan on the neighboring estate of Ropley sent word that a Vervain nest with two young had been found on a low branch only waist-high from the ground.

The featherless, black-skinned, awkward chicks were already some days out of the egg but their eyes were still closed. The bills were notably shorter than those of adults, and their pink cavernous mouths were yellow-rimmed. By casting a shadow over the nest with my hand, I got an immediate response; up shot the tiny heads with yellow-rimmed mouths tremendously agape. Also by tenderly tickling their bills with a straw, I could fool them into believing their mother had returned with food. Craning up to be fed, they revealed the ungainly structure of their minute, naked bodies. The pair of them could have been contained in a teaspoon.

The inside diameter of the nest was less than that of a quarter of a dollar, about $\frac{3}{4}$ of an inch. An exceedingly compact cup of fibres of the silk-cotton tree and other filamentous down, it was held firmly together by many yards of spider web.

The outside was liberally dotted with bits of green-gray lichen bound on by web. Sturdy, soft and well-camouflaged, it was the work of a capable and careful artisan.

As we studied the details, one of the nestlings deliberately elevated its rear end above the rim and ejected a squirt of liquid dung over the side to the distance of several feet. I marvelled at such instinctive sanitation.

The mother remained nearby, expressing her anxiety with diminutive squeaks. While I focussed on the nest, Mrs. Hallinan tapped the edge with a straw, causing the chicks to stretch in the posture of readiness to be fed. We hurried the photography and left.

Before the nestlings were fledged, I had to return to Miami, but Mrs. Hallinan observed their progress. She wrote that a week later one took up a position on the branch beside the nest, while the other remained inside. Ten days later the perching youngster disappeared, and in another two days the second was gone. This would be about the right time interval, I judge, from egg to flying.

When the pictures came from the laboratory, I felt that, possibly, we had recorded the smallest specimens of avian life ever photographed.

News from the Cordiers in the Congo

Editor's Note

FOR NEARLY TWENTY YEARS the adventures of Charles and Emy Cordier have been chronicled in *Animal Kingdom* as they collected birds and mammals for us, first in northern South America and later in the (then) Belgian Congo. To them we owe many of our greatest rarities. For the past several years the Cordiers — now “free lance” animal collectors — have been living in a more or less permanent camp in the Kivu, on the eastern side of the Congo, and at the outbreak of the independence disturbances in that country some apprehension was felt about their safety and their future as animal collectors in the new state. As for the latter, whether collecting for zoological parks will continue to be possible, nothing is yet known, but letters received in mid-July relieved us of fears for the Cordiers' safety at least during the turmoil of the Congo's Independence Day celebrations on June 30 and the following day or two.

The Cordiers have a staff of 31 at their camp — hunters and trappers, houseboys and watchmen and animal attendants. One, at least, has been with them more or less continuously since the Cordiers went to the Congo in 1948 for the Zoological Society, an expedition that came back in a DC-4 loaded chock-a-block with rarities. Most of the other employees are presumably local people from the village of Kabunga, approximately a hundred miles northeast of Bukavu. For them, country people all, Independence Day was not an occasion for rioting but for reasonably orderly celebration.

“We had planned to buy a cow and a pig to make a feast for our men on Independence Day,” Emy Cordier wrote. “But two weeks ago a houseboy stole the 5,000 francs set aside for that purpose, so I baked 58 loaves of bread for the men and their wives instead. They all got 50 francs each and free cigarettes.

“Last night [she was writing on July 3] was the last of four nights' celebration. On the 1st of

July they all came at 11 o'clock for a dance and to chant thanks to us. To make it a real celebration we decorated an empty storeroom and the flowers would have cost a fortune if they came from a Fifth Avenue florist. However, they all came out of our garden or the jungle.

“I hung up a Coleman lamp for illumination. We would prefer a dim, romantic light for a night celebration, but the men wanted everything as bright as possible. Augustin, the camp chief, brought his radio, and there was lots of dancing.

“Our people were well-behaved on the whole. What the new government has in store for us, we do not know.”

THE WEALTH OF SUPERSTITION and myth among the more backward peoples of the world is well known to anthropologists — and animal collectors. Charles Cordier ran into some particularly entertaining tales this past year and took the trouble to write to friends on the Zoological Society staff about them.

THE CHENUZI By Charles Cordier

Last fall I met for the third time an American missionary, the Rev. Mr. I. B. Burton. Knowing my occupation, he asked whether I could tell him the name of an aquatic animal his people often talked about. His own description of the animal, from hearsay, meant nothing to me and so he called in seven or eight natives. Most of them were teachers in the mission school and thus had a better than average ability to express themselves. Here is what they told the missionary and me:

The animal is called a Chenuzi and it has the size and general appearance of an 8-year-old child. Its head is rounded and covered with a profusion of red, stringy hair falling to its back. Its eyes are very small and black, its ears resemble those

of human beings, and its skin is reddish-brown. Some of the natives thought the skin was blackish toward the tail.

"What kind of hands and feet does it have? What is its tail like?"

There were a lot of different opinions. Some thought it had flippers and a fish-like tail. The missionary's cook was positive it had spindly arms, with four fingers on each hand, and that its body ended in a fish's tail carried horizontally and curved toward its back. He was positive because he had once seen a Chenuzi caught in a fish trap. The man who trapped it took it to the Territorial Administrator, who threw him in jail for killing the animal.

"Well, where does it live?"

"Always in very deep and shady pools in the rivers." What did it eat? Nobody knew. Would they be able to catch one for me? Oh, no; it is a dangerous animal. They weren't sure whether it bit, but it does send out electric shocks. (These people at the mission school were quite familiar with electricity.)

The worst thing about the Chenuzi was that hunters standing on the bank of the river above the pool might be hypnotized and fall in. Then they would sink like stone. And when they rose to the surface later, there would be a trickle of blood at the nostrils, for the Chenuzi sucks its victims' blood through the nose.

The missionary thanked his men and sent them back to work. We both smiled, and that was that.

Some time later I was bouncing along in my car on the long way to our camp. I don't know why I happened to stop for a native who was resting at the roadside, but to my surprise he turned out to be Thomas, a professional trapper and self-professed expert at Bongo hunting. I had met him a good while before and he had given me a lot of Gorilla lore. At the time he had struck me as a pretty competent fellow and I wished I had engaged him; now here he was, and free of other jobs, so I added him to my work force.

Skeptical as I was of the yarns told by the missionary's men, they had stuck in my mind and so, as we jolted along, chatting about various animals, I casually wondered out loud where I might find a Chenuzi.

"Around here, in most of the bigger rivers," Thomas said, just as casually. At such-and-such a place he had seen one sunning itself on a sandbank. But it was a wary creature and wouldn't be easy to get.

The relations between Thomas and me had long ago been established as those between two professional trappers, making a living in the same way, and I was careful to maintain the atmosphere of idle but still professional interest as we talked. I asked him to describe the animal. It was much as the missionary's men had given it — the head and the stringy hair were the same, but Thomas described the arms as short and spindly and terminating in five fingers instead of four. The hind legs were identical.

I remarked that I had heard it could give out shocks, but Thomas said no; people were confusing it with two other water animals, both much larger. These do give shocks, like the *nika* fish, and are much feared. They can paralyze people at six paces' distance. One is black and has a head like a Chimpanzee, and its spindly arms have hands with four fingers. Its body ends in a fish-like tail. The other electric animal has an elongated head, like an Aard-vark, two flippers instead of arms, and the flippers terminate in claws. Its body ends in a fish tail that is carried horizontally and curved upward, "like a piece of board stuck there."

Thomas was certainly specific enough in distinguishing among these various (mythological?) animals, but I decided to let the Chenuzi rest for a while and not take a chance of working up Thomas's imagination.

Back at camp I hailed Auguste Mwarabu, my trusted foreman and carpenter.

"Ever hear of a Chenuzi?"

"Yes, of course, Bwana. It hypnotizes people until they fall in the water, and then it sucks their blood. Everybody knows that."

"You believe that?"

"Of course, I have seen it with my own eyes in the Tshopo River above the dam the white men built. There were hundreds of people there and they all saw it."

"Does it have arms and legs?"

"I don't know, for I saw it only to its shoulders."

"Do you really think it sucks people's blood?"

"Of course it does!"

"Now, listen," I said. "You remember telling me that when the boss Gorilla runs away, he strings four vines across the trail to warn people away. You know you were with me on the Gorilla hunts, and we found out that wasn't true at all."

Auguste laughed, and I felt that I had planted a doubt in his mind about the Chenuzi's gruesome habits. Obviously he was just repeating common beliefs without any evidence whatsoever.

My next move was to get hold of a good Swahili dictionary and I found one at the home of the director of mining in our area. Against my expectations, the word was there. "Chenuzi . . . a water sprite." It was a word diffused by Arab traders and slavers in the old days, I think. Still, finding the word in a dictionary meant nothing.

About that time I had to go off to the Kivu highlands to collect birds on the shores of Lake Kivu, and I "talked Chenuzi" with many natives. None of them had ever heard of it. By this time I was really quite interested in finding out whether there might be an animal with some vague resemblance to the stories, and I figured that the Kivu ignorance was a point in its favor, for Lake Kivu is separated from the Congo basin by a high mountain range that would be an effective barrier to an aquatic animal.

Back at camp some weeks later I interrogated all 26 of the men we employed at that time and all had heard of the Chenuzi, but only two besides Thomas and Auguste had seen it — both from the same bridge over the Lowa River at Walikale. They said soldiers fired at it but didn't hit it.

I did collect some more Chenuzi lore, however. Venace Maibaridi (Coldwater), a lively and intelligent fellow, started to tell how, if a man is lucky enough to get hold of the Chenuzi's ring, he can command the world's riches, for the Chenuzi will give anything to get it back. One of the other men broke in to say that that was true enough, but it wasn't the Chenuzi's ring you must get — it was its comb.

What can you do about a gang of legend-makers like that?

Early this year a party of my men had to go to an out-of-the-way village on the Luholo River and Auguste Mwarabu, who has become rather

sheepish about Chenuzi stories but knows my interest, took occasion to make inquiries at the village. There were no Chenuzis in that neighborhood, but the villagers knew of a place on the Lowa River, a hundred miles away, where a road-makers' camp was abandoned because the Chenuzi "barked" so continuously.

The only thing of interest about that report was that the area they pin-pointed was the one mentioned by Bongo-expert Thomas.

Early in January a man came into camp with a strange story. He had been employed for three months, he said, by a former doctor in the Lubutu Hospital and the doctor and his family had established themselves on the Lowa River for the express purpose of capturing a Chenuzi. The native had been working at the river before the doctor arrived; his duties were to tend the flower garden and watch for the Chenuzi.

"That *mzungu* (white man) was surely anxious to catch it. He dived after it and tried to catch it with his bare hands. Sometimes he dived and stayed under water for five hours."

"Man," I exclaimed, "that's impossible."

"Well, he had all sorts of strange machines on his back."

"How come the man dived for it and didn't get killed by the shock the animal sends out?"

My visitor was not embarrassed or nonplussed. "You know that things that work against us black people don't affect you white men. You, yourself, caught huge Gorillas. What black man ever did that?"

We left it at that. In America, of course, I would pick up the telephone and call the doctor's home and ask him all about his Chenuzi-hunting expedition. Or maybe I'd just jump in the car and drive over there some week-end. It's only 70 miles away.

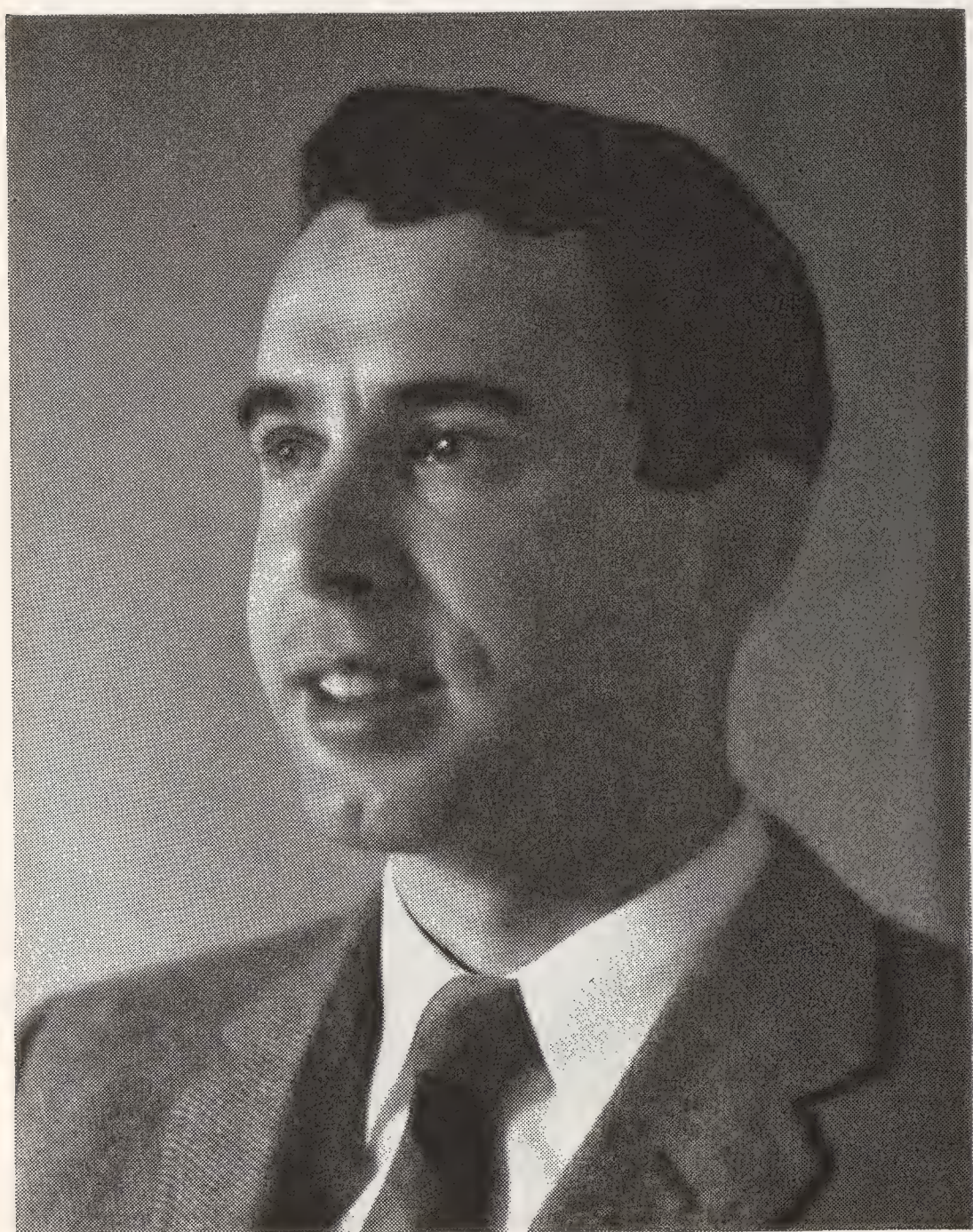
But this is the Congo, and not America. There are no telephones, at least in my part of the country. And a spot on the Lowa River 70 miles away might just as well be 700, for many of the bridges on the road to the Lowa washed out in the recent rains. It will be a long time before I can get over that way.

* * *

A Chenuzi — now *that* is an animal any Zoo would like to exhibit!

CONSERVATION

FOUNDATION



Belmont Pitkin

A new member of the Foundation's Research Department is Belmont Royce Pitkin of Burlington, Vermont. A graduate of Goddard College in 1952, he received his M.S. degree in Conservation at the University of Michigan in January, 1960, and is now working toward his Ph.D. from the graduate school of that institution.

From 1953 to 1956 Pitkin worked as Soil Conservation Aide of the S.C.S. at Cobleskill, N. Y., moving up to become Planning Draftsman in the office of the Town Planner, West Hartford, Conn., until 1957, when he was made Assistant Town Planner. In 1958 he entered Stan Cain's course at Michigan and became his assistant in 1959-60.

Already Belmont Pitkin has been made a National Wildlife Federation Fellow, a University of Michigan General University Scholar in Natural Resources, and has been elected to the Biological Honor Society (Phi Sigma).

Coming from a deep-rooted Vermont farm family, it is hardly surprising to find that Pitkin became exposed to conservation problems relating

to grassland farming, woodlot management and the production of maple products. Now, part-owner of 320 acres of Vermont farmland near Marshfield, he still feels a sense of accomplishment in having won over his father, the president of Goddard College, to the virtues of contour plowing.

Penobscot River and Estuary Study

The Conservation Foundation is about to embark (funds permitting) upon a water resource study of the Penobscot River and Estuary with particular emphasis on water pollution and its effects upon the general economy of the area.

A river survey will be required to ascertain the types and degree of industrial and municipal wastes responsible for present pollution and their effects upon aquatic life. The Atlantic Salmon will be the indicator species as regards the general condition of the river.

Briefly Noted

Professor Albert C. Worrell's study, "Pests, Pesticides and People," appeared in the July issue of *American Forests*. The article includes criteria for judging the merits of control programs, and as an example uses the history of the 70-year campaign against the gypsy moth in the northeast . . . Foundation trustee Laurance Rockefeller, with Wallace Bowman and Richard Cooley, met with Governor Egan of Alaska on July 2 in Juneau to discuss the recreation potentials of that State . . . The Audio-Visual Department reports that since publication of its Critical Index of Films and Filmstrips in Conservation on June 20, more than 2,500 copies have been distributed to colleges and schools, government agencies, private conservation groups and interested individuals . . . The first copy of a newsletter titled "A Bulletin on Conservation Education" was mailed to a selected list of 2,000 teachers throughout the United States during the week of July 25.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

Staff Appointments Announced for the Zoological Park

A series of staff appointments in the Zoological Park was announced on June 6 by Dr. Osborn and Dr. Tee-Van. Effective as of that date, William G. Conway became Associate Director of the Zoo, Charles B. Driscoll assumed the new position of Superintendent of Operations, Dr. Hernon G. Dowling became Curator of Reptiles and Gordon Cuyler assumed curatorial rank.

Mr. Conway, former Curator of Birds at the St. Louis Zoological Park, came to the Bronx Zoo as Associate Curator of Birds in 1956 and became Curator of Birds in 1958.

Mr. Driscoll was Assistant Superintendent of Construction and Maintenance from 1952 to 1956, and Superintendent of the Department since that time. His new position of Superintendent of Operations carries broader responsibilities.

Dr. Dowling, now Curator of Reptiles, came to the Zoological Park in September of last year as Associate Curator of Reptiles.

Mr. Cuyler, who joined the Bronx Zoo staff in 1947 as Assistant to the Executive Secretary, has been Administrative Assistant since 1958 and in charge of membership activities since 1956.

June Was "Baby Month" All Over the Zoo

In any collection of animals from both hemispheres, births and hatchings are likely to be well distributed throughout the year. Nevertheless June does produce a high percentage of the year's young, and seldom as abundantly as this year.

The Mammal Department reports the birth of a Roosevelt Elk; Wanderoo and Uele Colobus Monkeys (to be seen in the Monkey House), a Siberian Ibex on Mountain Sheep Hill, eight deer fawns of various kinds, two Llamas, two Yaks, a Bison, a Muntjac and an Eland.

In May we received word from the Institute of

Primatology in Japan that two males and three females of the Japanese Macaque were being sent to us. Six animals arrived — one of the females was holding a tiny baby in her arms when the shipping crate was opened.

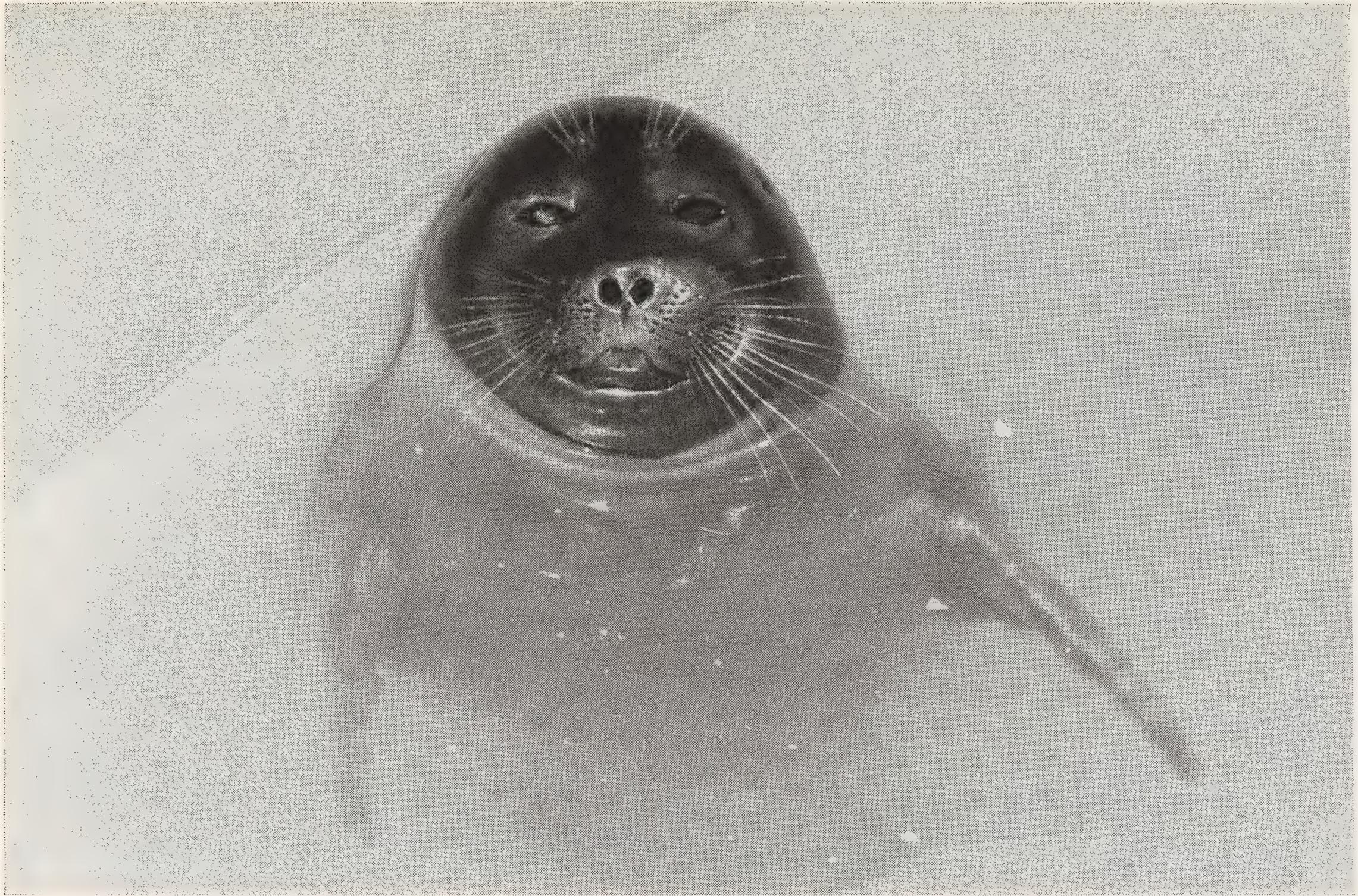
Almost five hundred eggs have been collected from cages and paddocks by the Bird Department this spring and many of them have been incubated and are hatching. There were two successes of special interest. A pair of Tacazze Sunbirds in the Jewel Room nested and hatched one young, which has now come out of the nest and is visible to the public. Mr. Conway comments that "The gleaming, quick-silvery Sunbirds have rarely been captive-bred anywhere, and to have a success in full view of the thousands of curious visitors who people our Bird House in the summer is nothing short of miraculous."

Even more gratifying is the success with the extremely rare Laysan Teal, on experimental loan from the Fish and Wildlife Service. They nested in the Marsh Garden and their three eggs were removed and placed in an incubator. All three hatched and the ducklings are doing well. They have been bred in captivity only once before.

The Reptile House has done equally well with snakelings. A Fer-de-lance bought from an animal dealer gave us a bonus of 14 young. And babies are in prospect from our second-generation Asiatic Cobras which have mated for the second year. We still have five third-generation youngsters from last year's mating.

Aquarium's Bermuda Collection

To add brilliance to its tanks for summer visitors, the Aquarium sent a collecting party of Drs. Ray and Nigrelli and Tankman Young to Bermuda in July. They returned on July 15 with a collection of 92 specimens of 19 species of reef fishes and invertebrates, most of which had been previously captured by Dr. Henry Clay Frick and Louis Mowbray, Director of the Bermuda Gov-



Indirectly through the Moscow Zoo the Aquarium has obtained its first Baikal Seal, the only species of seal confined entirely to fresh water. In Lake Baikal in Siberia it spends the winter under ice, breathing through blowholes.

ernment Aquarium. The fishes included six Rainbow Parrot Fishes, the largest three feet long and 30 pounds in weight; Bonefish, Indigo Parrot Fish and Long-finned Pompanos. Several Spiny Lobsters were brought back, one of them weighing 12 pounds.

IN BRIEF

Children and the Zoo. Floods of children in school groups swirl through the Zoo every spring and an impression that their numbers are increasing is borne out by statistics compiled by the Education Department. In June alone more than 1,600 school and other organized groups, totalling about 67,000 persons, visited the Zoo and the Farm-in-the-Zoo. The department's school lecture service reached an additional 3,000 students in that month.

Sign of Summer. June and July, when city children go to summer camps and have to leave their pets behind, always bring a shower of gifts to the Reptile Department. This year the department received 52 turtles, most of them from children. The donations will be doubled in late summer when the youngsters return from camp with turtles and snakes — and find their parents unsympathetic.

“Bronx Zoo Kits.” The avidity of the Zoological Park's visitors for detailed information about the highlights of the collection — and their response by becoming Members of the Society — are illustrated by our experiences with “Bronx Zoo Kits” distributed this summer for the first time. The Kits, which are merely an envelope containing a mimeographed page of comments on recent acquisitions and particular rarities, two folders giving general information about the Zoo and the Aquarium, and a Membership promotional booklet, have been given to every party coming to the Zoo by automobile. In the short time the Kits have been distributed, 62 new Members have joined the Society from that source, including 10 Contributing, 1 Supporting and 1 Life Member.

PUBLICATIONS OF INTEREST

MEET THE SOUTHWEST DESERTS. By Philip Welles; photographs by Marvin H. Frost, Sr. 96 pp., 1 map, 13 line drawings, 106 halftone illustrations. Dale Stuart King, Publisher, Six Shooter Canyon, Globe, Arizona, 1960. Light card cover, \$1.00; cloth, \$2.25.

The author has squeezed a wealth of information about the more common plants and animals of the Great Basin, Mojave, Sonoran and Chihuahuan Deserts into this neat little book. Written in a quick and easy style and profusely illustrated with fine photographs, this is an excellent introductory guide to the desert lands of our southwest. — D. REVILLE.

THE SEA-HORSE AND ITS RELATIVES. By Gilbert Whitley & Joyce Allan. ix + 84 pp. 55 black-and-white drawings, one color plate. Charles T. Branford Co., Boston 59, Mass., 1958. \$6.00.

The popularity of seahorses has become axiomatic among aquarium men; let us shut down the seahorse exhibit at the New York Aquarium for only a few hours and we are bombarded with questions: "Where are the seahorses?" This book takes up all aspects of the charming creatures, their structure, habits, life histories and relation to man. It also describes some of their relatives which are less well known but just as strange as they are. Both layman and professional will find this a useful and entertaining volume — J. W. ARZ.

New Members of the New York Zoological Society (Between May 1 and June 30, 1960)

Benefactor

Miss Alice Tully

Patron

Mrs. Albert Spalding
Alfred Gwynne Vanderbilt

Life

Mrs. Myrtle S. Doubek
Richard Proskauer
Miss Joan Van Orden

Supporting

Mrs. Bernard F. Gimbel
Mrs. Margaret M. Grand
Joseph B. Martinson
Perry R. Pease
Mrs. George W. Perkins
Mrs. William P. Roth
Frederick M. Warburg

Contributing

Mrs. Selma Aks
Miss Amey Owen Aldrich
Paul H. Arthur
George A. Brakeley
Herbert Bye
Mrs. J. B. Campbell
Miss Martha Casamajor
Mrs. Beverly-Jane Cotter
J. Cheever Cowdin
Dr. Samuel D. Danzig
Gregor D. Dengler
Lewis W. Douglas
Charles F. Flint
Prescott LeB. Gardner
Elbridge T. Gerry
Mrs. Caral Gimbel Greenberg
Murray Handwerker
Mrs. John W. Harris
Thomas M. Heyman
Mrs. R. V. Ingersoll
Frederick Jones, Sr.
B. R. Kittredge
Benjamin Kurz
Mrs. Doris Le Strange

Mrs. Eric M. Maynard
George V. McLaughlin
Mrs. Earl E. Moore
Fred M. Moran
Robert Rogolsky
Mrs. R. Alfred Saenger
T. J. Shanahan
Mrs. Elinore Soja
Victor J. Stein
John P. Stevens, Jr.
Arthur Vernay
Mrs. L. A. Wyman
Miss Katherine J. Zinsser

Annual

Archie Albright
Douglas Appell
William Aronsohn
Miss Maud Austin
Mrs. F. E. Bagger
Joseph Balzano
Charles A. Barton
Miss Ann L. Beatty
Stephen W. Borden
Dr. Blanche A. Borek
Dr. William H. Button, Jr.
Miss Louise Arlene Byer
Francis V. Calicchio
Mrs. Grace E. Carlson
John C. Case
Mrs. John C. Case
Morris Davis
Dr. Frank De Luca
Mrs. Thomas W. Dewart
Michael Egan
Richard Arthur Ehman
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Ernest M. Fishman
Stanton L. Frankle
Mrs. Abraham Freedman
Walter Fried
Charles Gerlach
Mrs. Irwin N. German
Joseph P. Gherardi
Abraham Goodman
Mrs. Paul Gourary
Mrs. Martin Gross

B. Brower Hall
Mrs. William L. Hearne
A. D. Heller
Mrs. Fred Hemmer
Mrs. Abraham Jasson
Richard Kalanz
Hamilton F. Kean
Henry Kohn
Robert Jon Kornfeld
Miss Alexandra Krastin
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Sidney H. Lawrence
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Elmo Marino
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George L. Meyer
Rev. Philip A. Mulleedy
Henry C. Nelson
Lawrence W. Newman
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Frank Pereira, Jr.
Dr. Francis A. Pflum
Ward Randol
Max C. Ratner
Mrs. T. P. Raulerson
Mrs. Norman D. Richardson
Mrs. Dudley J. Ridley
Wilfred P. Riggs, Jr.
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Joel E. Rubin
Irving Schachtmeister
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Elwood Siegel
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Mrs. Ada Spagnesi
Joseph C. Strom
Dr. Abraham B. Tamis
Marvin Weinstein
Mrs. Paul Windels, Jr.
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TAKE THE CHILDREN TO THE FARM-IN-THE-ZOO.
THE CHILDREN WILL ENJOY THE SHEEP
SHEARING DEMONSTRATIONS-MILKING OF COWS
AND ALL THE DIFFERENT KINDS OF FARM AND
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LYONS

WE'RE DELIGHTED that N. Y.'s Transit Authority is showing the placard reproduced above to its 4,500,000 daily subway riders. Our only regret is that this provocative sign isn't big enough to tell about some of the other engaging animals in the Zoo and Aquarium just now.

First place among these belongs to the temperamentally inquisitive White Whale now swimming and spouting at the Aquarium, in the same saltwater pool with "Ookie," the baby Pacific Walrus.

Next comes the abundant crop of baby animals now in the Zoo. There are Formosan, Barasingha, Père David's, Axis and Chinese Water Deer fawns, Roosevelt Elk, Eland, Bison, Llama, Siberian Ibex and Yak babies and infant Uele Colobus and Wanderoo Monkeys.

Hatchings among our exotic wildfowl have been spectacular. On our ponds, pools and rivers there are now Black-necked Swan cygnets, Laysan Teal ducklings and goslings from our Ashy-headed and Magellan Geese. In the Jewel Room, the Tacazze Sunbirds (with no help at all from the incubators) produced a tiny youngster. The African Pythons, oviparous also, have hatched some forty-odd snakelings.

YES, WE'D LIKE TO SEE the subway sign include all these vital facts and end up with a strong plea for Membership support of the Society that runs the Zoo and Aquarium. But realistically we have to admit that no sign is big enough to get the Society's message across, so we will depend, as always, on our Members to do that. Tell a friend today what's going on in the Zoo and Aquarium!



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ANIMAL KINGDOM

THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

General Offices: 30 East 40th Street, New York 16, N. Y.

Richard A. Cooley, *Director*
Alaska Research Station, Juneau

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Altruism in Africa

AT A TIME when the news coming from Africa reveals one incident after another of strife and "the hand of man being turned against man" it is a relief to hear that elephants, at least, are altruistic and working in each others interests. The following episode is reported in the current number of "WILD LIFE", the magazine of the Kenya Wild Life Society:

"Two Rangers of the Meru District Game Reserve, returning to camp from patrol, were attracted by the sounds of an elephant obviously in some sort of trouble. They found a bull elephant of about 15 years, well and truly trapped in a steep-sided and slippery mudhole.

"Although struggling desperately, it was obvious that without some sort of assistance, it could not escape. The Rangers started off back to the camp to report, and then noticed two more bulls approaching the mudhole. They withdrew a short distance, and waited to see what would happen. The newcomers walked all round the trapped elephant, obviously puzzled and at a loss. They then made off in the direction from which they had come, but stopped when what the Rangers describe as a 'very big bull elephant' appeared.

"The three then returned, and again circled the mudhole, stopping from time to time to trumpet loudly, and giving every sign of nervousness. By this time it was nearly dark, and the Rangers decided to wait until morning: this they did, spending the night up in a tree. As it finally grew too dark to observe detail, they noticed 'many elephant' moving in towards the mudhole.

"The animals were heard throughout the night, and in the morning it was found that the trapped elephant had been freed, and the whole herd had moved off. The Rangers' examination of the mudhole revealed without doubt what must have been a combined operation.

"One complete side of the hole, and half of another side, had been gouged and trampled to form what was almost a ramp, and marks in the soil revealed that a number of the elephant had used tusks in this operation. From the considerably tramped-down condition of the 'ramp' and slide marks at its lower end, it appears most likely that several elephant had been levering and/or pulling at their trapped companion."

Such examples of "helping the other fellow" are not rare among animals, having been observed quite often not only in the actions of elephants but of a number of other animals.

Is there a moral? There ought to be!

Fairfield Osborn

BURMA WILDLIFE SURVEY

By OLIVER M. B. MILTON

Leader of the Survey

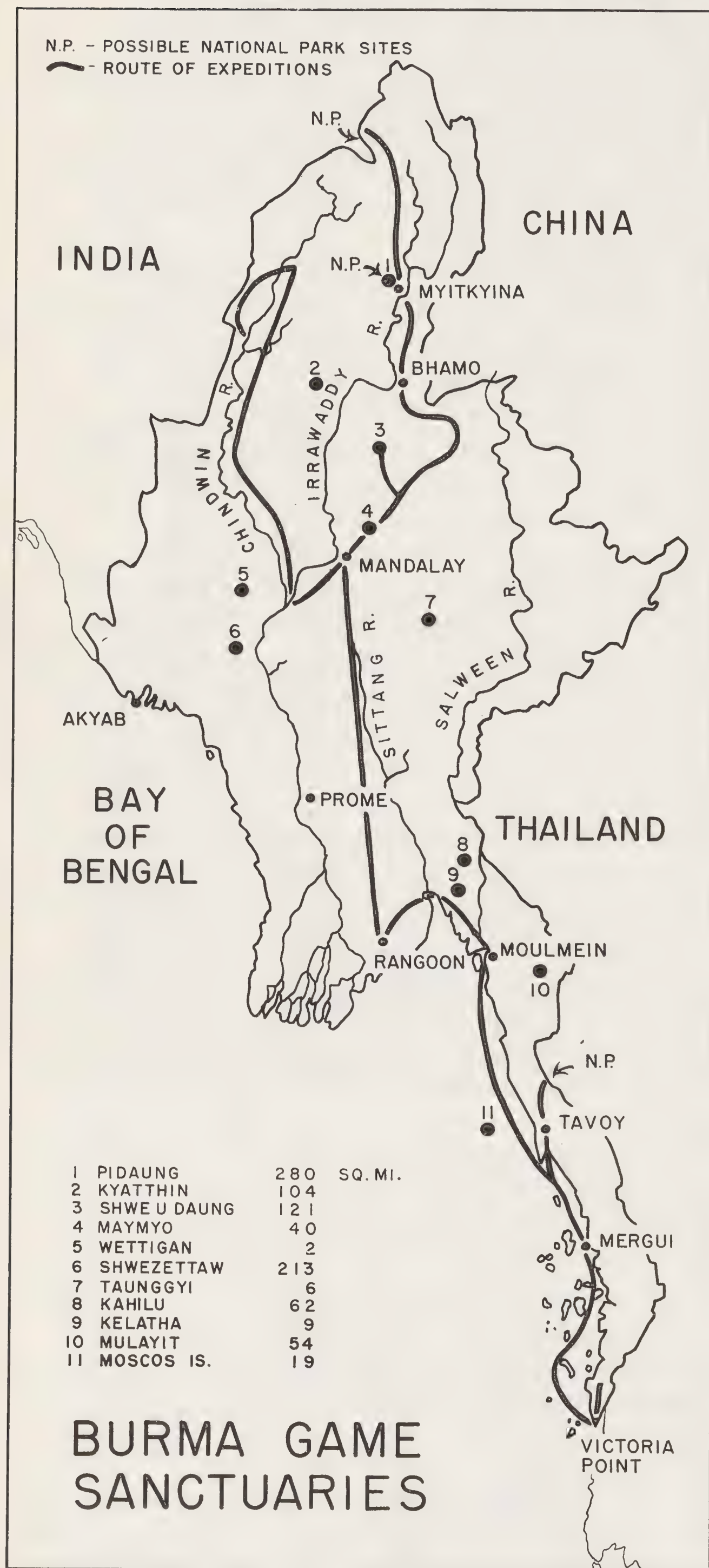
THERE HAVE BEEN a few references to the "Burma Wildlife Survey" in *Animal Kingdom* in the past year, but always in connection with the Takin that Dick Estes and I discovered in a hill village of North Burma and eventually managed to send to the Bronx Zoo. Lest the work of the Survey be fixed in the minds of the Zoological Society's members as Takin-hunting pure and simple, I am taking advantage of *Animal Kingdom's* invitation to report what the Burma Wildlife Survey is, its connection with the Zoological Society, and what it has accomplished and hopes to accomplish.

I should perhaps identify myself first. From 1949 to 1955 I was a Game Warden in Tanganyika, East Africa, where a lifelong interest in wild animals and their protection found an outlet. Prior to this I had lived in Burma from 1937 until 1948, mostly among the Chinghpaw (Kachin) people of the northern provinces. Here I formed a deep and abiding affection for the people and the

Left — Map of Burma, showing existing Game Sanctuaries and possible National Park sites suggested by the Burma Wildlife Survey. Right — Mountain torrents had to be crossed each day during the 250-mile walk into north Burma, but usually the Nagas had built crude bridges out of bamboo and cane.

All photographs by the author

country so that, when more settled times came, I felt a strong urge to return to Burma and do what I could to foster nature reserves and national parks. After taking a course in conservation at Yale University under Dr. Paul B. Sears I was fortunate enough to gain the financial backing of a number of friends and the sponsorship (and financial support) of the New York Zoological Society, the International Union for the Conservation of Nature, the American Committee for International Protection of Wildlife and the Peabody Museum at Yale University. Until





May, 1960, Richard D. Estes has also been a member of the Survey. He graduated from Harvard and, as one of his main interests is animal behavior, he studied under Dr. Konrad Lorenz in Germany during the summer of 1958 before coming out to Burma. So much for background.

THE INDEPENDENT COUNTRY of the Union of Burma (about 260,000 square miles) stretches from the 28th to the 10th degree of latitude north of the equator and is adjacent to India, China (Tibet and Yunnan), Laos and Thailand.

North of Rangoon (approximately the 16th degree) its elongated shape is clearly divided by the broad and slightly tapering Irrawaddy valley which forms the principle rice growing region in the Union. To the west lie the Chin Hills which border Assam and Manipur; in the north the snow covered peaks of the Kachin State rise to more than 19,000 feet and to the east rugged mountains form the frontier of Yunnan, Laos and Thailand.

The great range of geographical, climatic and soil features have provided the country with a



unique wealth of flora and fauna. The alpine meadows and climax rhododendron forests of the far north contrast sharply with the semi-desert conditions found in central Burma near Mandalay. Different again are the virgin tropical evergreen rain forests and mangrove forests that dominate the tail-like southern extremity of Burma which stretches from the 16th to the 10th degree of latitude between Thailand and the Andaman Sea.

Besides the commoner species of animals which one would expect to find in the country (Gaur, Banteng, Sambhur, Tiger and the like) both Himalayan and Malayan species are represented by such animals and birds as the Takin, Tapir, Tragopan and Argus Pheasant.

Like many other countries, Burma's wildlife has been seriously affected during the last two decades by uncontrolled hunting. In the last war several of the existing sanctuaries became battlefields on which no heed could be taken for the lives of the birds and animals. Since the war the country has been troubled by anti-government elements whose presence in the jungles has made it almost impossible for the authorities to carry out any satisfactory and lasting conserva-

This huge drum, made from the trunk of a tree, overlooks the valley up which the Survey party walked in Takin country. Beating it, the Makware headman summoned men for porters.

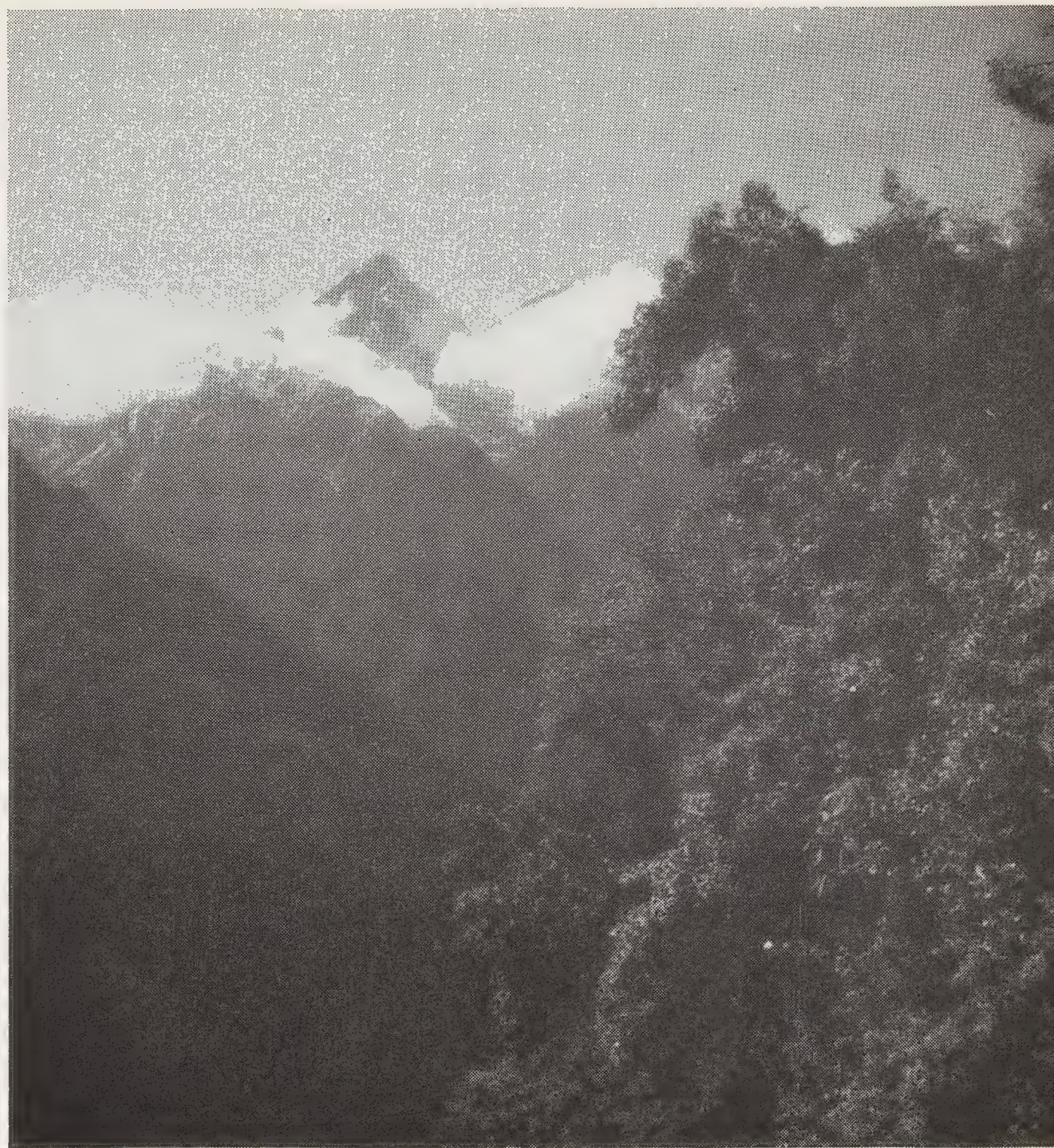
tion work. For many years Burma has lacked an individual game or wildlife preservation department. Members of the Forest Department have been assigned for this work but the system has not been entirely satisfactory since they have neither the time nor the training and experience to carry out this important work. Finally, as the whole economy of the country was shattered during the war, all available finances have since been devoted to rebuilding. This left a very small allocation for the wildlife preservation program.

In January of 1958 I approached the Burmese authorities and sought permission to carry out a two-year (at a minimum) study of the fauna with the ultimate aim of offering ideas and suggestions for the continued and improved preservation of their national fauna. For the next seven months I looked for finances in the U. S. A. to keep us in the field and by September I decided to leave for Burma even though permission had not yet been received to work there. My wife, Ann, our

small son, Eric, aged 3½ years, Richard D. Estes and I waited in Rangoon until sanction was finally granted early in November.

One of our main objects was to find out whether any of the rapidly vanishing Sumatran and Javan Rhinoceros still remained in the country and if so what steps could be taken to ensure their further protection in their natural habitat. During June of 1959, the tracks of two Sumatran Rhinos were seen in the Shwe U Daung sanctuary near the ruby mining center of Mogok; it is possible that there is a third specimen. We learned that 17 Rhinoceros had been shot in this sanctuary since 1942. It is doubtful whether the population of Rhinoceros in Burma can ever be determined but it seems reasonable to say that there *might* be between 20 and 30 Sumatrans and one or two Javans still left. Native reports say there are as many as 50 in one area but this seems not only excessive but improbable.

There is a strong belief that the horn, skin, blood and urine of the Rhinoceros possess power-



After a climb of 7,000 feet, these peaks were revealed — the possible site of a National Park on the Burma-Assam border. This wild country is the home of Takin and Musk Deer.



The Survey's camp at 8,850 feet in a rhododendron forest ablaze with crimson blooms. Moss hung from every tree. Sunlight was a rare event and there was ice in the streams.

ful medicinal properties (aphrodisiac) and so the animal is hunted to procure these products. In June of 1960 the Asia Foundation very kindly contributed to our work by printing 5,000 posters in Burmese on a "Save the Rhinoceros" theme and these have been distributed throughout the country, in the hope that they will have some effect on the public.

Although there is general hunting for food and recreation, it has not yet seriously threatened the wildlife population except for one or two species. Each year natives spend three months in the north Burma alps hunting the Takin and Musk Deer. In 1958 more than 20 Takin were shot *in one day* near a salt lick. The meat is said to be very tasty and the thickly-haired skin makes warm apparel for the hunters. The horns also have a market value, as they are believed to ward off fire and sickness if hung in a house.

The Gaur and Banteng are shot mostly for their heads, which make fine trophies. However

because their type of habitat often presents considerable difficulty for the hunter, neither species is in any grave danger.

The Thamin or Brow-antlered Deer is more easily approached and in the dry zone of central Burma a couple of dozen have been shot in one day and over a period of a week two or three have been killed every day. To date the Survey party has not had time to visit their habitat but plans are already made to do this later.

In southern Burma fishermen from the mainland visit the Moscos Islands (west of Tavoy in Tenasserim) and wait for the turtles to lay their eggs. Once this process has been completed the turtle is killed and the eggs removed for sale in the local market. Until the Government is able to form a separate wildlife preservation department which can operate actively in the field, the lives of all animals must remain under a constant threat.

In the course of the Survey we visited the far northwest on the Assam-Burma divide. This is the habitat of the Takin, Musk Deer, Serow,

There is a wealth of good conservation advice in this sign nailed to a fence at the Mandalay railway station! Many Burmese are sincerely interested in the protection of their wild life.

Tragopan and Monal. Three months were also spent in the Naga Hills on the Assam border, during which time we climbed Mt. Saramati (12,553 ft.). This mountain had been climbed once before, by a Burmese, but never before by an occidental.

We also devoted four months to the Pidaung sanctuary near Myitkyina in north Burma. In prewar days this was an area to which many people went to look at the wildlife. Unfortunately it became one of the major battlefields during the war and the animal population even now is only a fraction of the former figure. We found that many villagers had moved within the boundaries, and that they grazed their cattle and goats there, cut timber and shot many of the mammals and birds. Formerly Gaur, Banteng, Sambhur, Barking Deer, Bear and Tiger were plentiful but their numbers are now greatly reduced. However by the very praiseworthy efforts of an Army officer, Col. Saw Myint, who himself is an ardent conservationist, a wildlife protection society has been formed and steps are being taken to restore the Pidaung to its former status as soon as possible.

Last February we spent some time in the southern part of Burma in Tenasserim and the islands of the Mergui archipelago. The mainland contains some remarkable virgin rain forest and is the





Near the Thai border in southern Burma numerous hot springs arise. Footprints in foreground are those of Elephants. With a Thai area, it could make a small International Park.

home of the Tapir and Argus Pheasant. There are several Sumatran Rhinos in the area and possibly one or two Javan. It is for this reason that I have suggested the formation of a small National Park of about 450 square miles along the Thai border. It is hoped that the Thai authorities may declare the adjacent area on their side as a Park also, thus forming an international park, the first in southeast Asia.

Verbal approval has been given for the extension of the Survey's work into a third year and although written permission has not yet been received we hope that we can continue until the end of 1961 and possibly later. The Prime Minister, U Nu, and other high ranking officials have expressed their interest in the Survey's aims. The Asia Foundation not only printed the posters

mentioned above, but has promised to print two books on the Burmese fauna. These are being compiled by members of the Survey with the assistance of the New York Zoological Society and the American Museum of Natural History. My wife is drawing all the illustrations. The first will deal with the less known and most endangered species in Burma while the second will be in the form of a popular handbook of Burmese animals. At present there is no up-to-date publication on this subject and so we are trying to produce a book that will not only be readable by the general public but acceptable to the Burmese educational authorities for use in the schools.

In conclusion I would like to thank not only our sponsors and the other persons who have given such generous financial support but also the Burmese Government — in particular, the Chief Conservator of Forests, U Chein Hoe. The officials of the Forest Department have given us the fullest cooperation without which our task would have been beset with many difficulties.



STONEFISHES THE WORLD'S MOST VENOMOUS FISHES

By JAMES W. ATZ

Associate Curator, New York Aquarium

THE STONEFISHES are the world's most venomous fishes. Such categorical statements are seldom safe to make when dealing with such biological variables as the strength of animal poisons and the health and immunity of creatures subjected to them, but there is no question that Stonefishes are in a class by themselves. Consider, for example, the case of the strong, healthy man who was spear-fishing on a Mozambique reef four years ago. He accidentally kicked a Stonefish so that just one of its spines penetrated his toe. Within an hour he was dead. Or consider the Australian woman who was similarly stung by a single Stonefish spine that entered her big toe through a small hole in her wading shoes. During the following twelve hours she passed through two crises when she seemed more dead than alive and although she eventu-

ally recovered, she suffered from shortness of breath and excessive tiredness for several months thereafter.

Two of the worst features of Stonefish stings are the terrific pain and the crippling after-effects. There are appalling accounts of how men have rolled on the ground, frothed at the mouth, attacked people trying to help them or tried to amputate the affected limb, so great was their agony. Even natives whose custom it is not to show pain are usually reduced to writhing and screaming. The intense pain may last twelve hours, but some discomfort may be felt for as much as a year afterwards.

The great majority of encounters with the Stonefish have taken place far from medical facilities or places where records are kept. Statistics are therefore non-existent, but the relatively

few instances witnessed by doctors and travelers have so impressed them that they all have apparently felt called upon to describe in detail what they saw.

Stonefishes occur over a wide area of the tropical Indo-Pacific, all the way from the east coast of Africa and the Red Sea through the Indian Ocean to Australia, the Philippines and the Tuamotu Islands. They are bottom inhabitants of shallow waters (as far as the ocean is concerned), most likely not living at depths much greater than 100 feet. Fortunately for the people who get a living from the sea in this vast region, Stonefish, even though they frequent waters from a few inches to all wading depths, typically seek the shelter of some rocky or coralline bulwark, away from treading feet. Moreover, no-

Outlined against white sand, a Stonefish is quite visible, but its gray, white and brown markings aid in concealing it against a more broken background. This adult specimen in the Aquarium is 7 in. long.

where can they be said to be common, although a goodly number may be regularly turned up by a naturalist thoroughly acquainted with a given area — as Mr. George Coates of Queensland and Curator Alex Fraser-Brunner of the Van Kleeef Aquarium in Singapore have demonstrated by supplying numerous living or specially preserved specimens to scientists for research. Ordinary fish collectors carefully avoid Stonefishes, and consequently few living ones have ever reached this country. We were therefore especially pleased last May when Curator Earl S. Herald of the Steinhart Aquarium in San Francisco offered us one of his two specimens as part of an exchange in which we sent a pair of Sand Tiger Sharks to his institution. Our specimen probably came from Eniwetok, an atoll of the Marshall Islands, and thus has the scientific name of *Synanceja verrucosa*. Two other species of Stonefish are generally recognized, *S. horrida* and *S. trachynis*. All three look more or less alike and all three appear to have the same habits and the same degree of venomousness.

The Stonefish is appropriately unprepossessing in appearance. Its body abruptly tapers from an oversize, flattened head to a short, blunt tail. It completely lacks the grace and symmetry asso-

ciated with the typical streamlined fish. Instead of scales, its skin is covered with wart-like excrescences which extend onto the dorsal fin and the two large pectoral (shoulder) fins, transforming what are ordinarily thin, pliant structures into stiff, rugged ones. A finishing touch is the thick layer of slime that coats the entire fish. All this might seem unnecessarily repulsive, until the creature is viewed against a natural background. Then the many irregular bumps and depressions, the fringe that conceals the opening of the mouth, the spines that break up whatever vestiges of a contour the head might have, and, particularly, the blotched and mottled coloration, all conspire to make the Stonefish look like a rough stone or a piece of dead and weathered coral.

The effect is uncanny. That it should operate in the fish's natural environment — with its countless odds and ends of coral bits, algae, shells, pebbles and debris of all sorts, to say nothing of small animals of various types — is perhaps not surprising. At the New York Aquarium, however, we could provide the Stonefish's 100-gallon tank with only a layer of coral sand and three or four pieces of tufa, a soft, porous rock that bears a remarkable resemblance to weathered coral. Yet the Stonefish blended so perfectly into this drastically simplified and artificial environment that special labels had to be put up to tell our visitors how to find it. I am sure that a number of them went away without ever seeing the fish although they had undoubtedly looked directly at it as it lay next to a piece of tufa, its pectorals barely buried in the coral sand, motionless except for the faintly visible rhythmical breathing movements made by its gill-covers. To my repeated amazement, I found that even I, who knew exactly what the fish looked like, sometimes had to systematically scan each square inch of the bottom until — there! There it was all the time!

No wonder the Stonefish gets stepped on, for in addition to its perfect camouflage, it has the habit of remaining exactly where it is, no matter how much commotion may take place in its immediate vicinity. So adverse to moving does the fish seem to be that it will permit a snail or shrimp to crawl over its head without response.

Resting immobile on the bottom of a tidepool or coral flat, the Stonefish is perfectly positioned to deliver the full force of its venom to anything



A mere lump, the Stonefish lies in a corner as food — a strip of fish — is brought toward it on the end of a wire. At a distance of 2 inches —

coming down on it from above, for along the middle of its back is a series of 13 spines, each equipped with a pair of sacs containing venom. These comprise most of the dorsal fin, but only the needle-sharp tips of the spines project beyond the fin's warty base. The sacs are closely applied to the right and left sides of each spine. From each sac a tubular extension runs along a groove to the tip of the spine. When the sharp spine penetrates flesh, pressure is applied to the sacs, which then discharge their contents through the ducts into the wound. In order to put this formidable apparatus into full play, the fish simply erects its dorsal spines. Although the arrangement does not allow for the forceful injection of relatively large amounts of fluid into the wound, as do the hollow fangs of viperine snakes, the extreme virulence of the Stonefishes' poison undoubtedly compensates for any mechanical inefficiency. Three similar but not quite so well developed venomous spines are included in the anal



— the Stonefish strikes. It jumps forward, its comparatively huge mouth opens, and too quick for the human eye, the food disappears.

fin, and each pelvic (belly) fin has a single one. Because of their location, however, these five spines are seldom, if ever, involved in Stonefish stings.

The amount of venom in each sac varies; in fact, some spines lack sacs entirely. These may be spines that have penetrated some animal in the past, because the deep insertion of a spine could very well cause serious injury to the delicate sacs, which are located rather close to the tip. At any rate, the existence of "dry" spines accounts for the few instances in which people have been stung by a Stonefish but have suffered no pain or other unpleasant after-effects. A full sac, which also includes the glandular tissue that secretes the opalescent fluid, may contain nearly 10 milligrams of actual venom, enough to kill a thousand mice. (For comparison, it might be pointed out that an unused postage stamp weighs about 65 milligrams.)

Stonefishes use their venomous spines only



A dissection of a Stonefish spine. Lying on either side of the spine are the sacs containing the venom, which is injected through ducts.

Photo by Stanley Weitzman from "The Aquarium Journal"

for defense. For food they appear to depend on their camouflage and ability to snap up with incredible speed any morsel that comes their way. The method of lying in wait and then making a short, open-mouthed leap at the unsuspecting prey must work well—at least, many of the Stonefish that have been collected have had their stomachs filled with small fish. One 12-inch specimen contained 10 such fish. Tankman Edward Dols has inveigled our Stonefish into eating a variety of unnatural foods, including pieces of fresh fish, clam and shrimp. Mindful of the gluttony of the species, we rarely feed our Stonefish all that it will consume. Fishes of its type can eat themselves to death.

Long before there were any bathers or fishermen, evolution had produced the elaborate defense mechanism of the Stonefish. Presumably it was developed because it protected the Stonefish from larger fishes. We do not know what effect Stonefish venom has on fishes, however,

because no one has performed the necessary tests. The venom is toxic to frogs, so we have some indication that it is effective on animals that are cold-blooded, like fishes. But I cannot help wondering whether Stonefish poison became the kind of chemical it is because of some effect it has on fishes. Man is a Johnny-come-lately in Stonefish life compared with piscine enemies; the acuteness of Stonefish poisoning in man can only be considered an unfortunate by-product of evolution.

A substance as powerful as Stonefish venom could hardly escape the attention of biologists and pharmacologists, and yet up to 1959 there were only three published experimental investigations on the subject. In that year, Dr. S. Wiener of the Commonwealth Serum Laboratories in Australia and Dr. Paul R. Saunders of the University of Southern California's School of Medicine published the first results of their work on the properties of Stonefish venom. They found that it affects both the nervous and the circulatory systems, but its mode of action is still a mystery. During the recent conference on the Biochemistry and Pharmacology of Compounds Derived from Marine Organisms (organized by the Aquarium's Pathologist, Dr. Ross F. Nigrelli), Dr. Saunders declared that more is known about how the poison of the Stonefish does *not* cause its effects than how it does.

In the meantime, definite progress has been made in the treatment of Stonefish stings. It has been discovered that emetine hydrochloride, when injected into the wounds, provides dramatically rapid and permanent relief from the severe pain—something that no other substance has been able to do. Moreover, this drug seems to neutralize the toxic action of the poison. In 1958 another important advance was made when Australia's Commonwealth Serum Laboratories produced the first Stonefish antivenin by injecting the venom into horses, in the same way that snake antivenines are often produced. Although this material still has limited distribution, it has unquestionably demonstrated its worth. No longer need a Stonefish sting be the drawn-out, agonizing affair that it has been in the past. The Stonefish will always be one of the world's most dangerous fishes, but it has now been robbed of much of its terror.

ZOO NEWS IN PICTURES

Photographs By SAM DUNTON

This homely youngster posing affectionately with his mother is the first **MANDRILL** born in our collection. He arrived (somewhat to our surprise) on the morning of August 5 and now, two months later, is a prime attraction for every visitor to the Monkey House. Most of the time the baby and mother stay on the high ledge at the back of the compartment while the father stands guard below. The baby is now making short forays away from his mother and experimenting with solid food, but most of the time he is playing with it rather than eating.



When we acquired our first **PALLAS'S CAT** in the spring of last year, we tried unsuccessfully to obtain a male at the same time. One has now arrived and has been introduced to his mate. They took to each other immediately and have been settled in an outside compartment at the Small Mammal House. Pallas's Cat comes from the Siberian steppes, the Mongolian deserts and the highlands of Tibet.



THOMPSON'S GAZELLE, otherwise known as a "Tommy," is a familiar sight on the plains of Africa, but unfortunately a rare sight in the New York Zoological Park. This young male is, in fact, the first we have ever exhibited. At the moment it is undergoing acclimatization in the African Plains shelter house but will be liberated on the Plains a little later this fall. Eventually we expect to get more of the gazelles and develop a herd.



These trim little birds are the first **HIMALAYAN RED-LEGGED FALCONETS** we have exhibited. Falconets are the smallest of the Falcons, not much larger than sparrows. Nevertheless they are bold, fierce and swift and have been known to take birds larger than themselves.

Now that cool fall weather is here, life probably looks a bit cheerier to our **TAKIN** from the mountains of north Burma. The hot and humid mid-summer weather was obviously hard on the animal and so its stall in the Antelope House was air-conditioned. The only trouble with that was that the Takin disliked confinement indoors. It is growing slowly and becoming more aggressive, although it is still reasonably good-natured toward Antelope Keeper Neil Dapolite.



Animal Expeditions

Had Drama in 1912 —

THE PIGMY HIPPOPOTAMUS STORY

NOWADAYS, when it seems unlikely that the wilder places of the world will ever again yield a large and impressive and totally unknown animal, it is worth recalling that things were not always thus — that “first time on exhibition” animals were almost a commonplace in the early years of this century. Not that they were actually looked upon as commonplace; there was a stir and excitement over important new animals that still lingers in the printed accounts of their capture. In the course of its sixty years the New York Zoological Park has had a large share of first-timers, some of them the first to be exhibited in the New World and some the first seen alive anywhere.

Many, of course, are now frequently seen in the larger zoological collections, for once their source was found and methods of capture, acclimatization and transportation worked out, animal collectors quickly undertook to meet the demand for them. Others are still comparatively rare, and an example is the Pigmy Hippopotamus, *Choeropsis liberiensis*. Two males and a female which came to the New York Zoological Park on July 9, 1912, were the first ever seen alive in America. A few others have been imported since then — our present pair are offspring of those obtained by the National Zoological Park in Washington — but they can still be considered rare and to many people quite unfamiliar animals.

Indeed, they may long continue to be so, for an animal collector who recently visited Liberia in the hope of bringing Pigmy Hippopotamuses out, found that they had long since disappeared from the coastal areas and could be found only in the all but untracked deep interior. He saw five animals, but captured none, for he became ill and himself reached the coast only after many difficulties.

The three animals that came to the New York

Zoological Park 48 years ago were not the first to be exhibited anywhere; the Dublin Zoo had that distinction. Carl Hagenbeck, the German animal dealer whose emissary captured our specimens, asserted that the first Pigmy Hippopotamus seen alive in Europe was sent to the Dublin Zoo “in the sixties” and lived for several weeks. Dr. William T. Hornaday, who was Director of the New York Zoological Park in 1912, gave the year of the Dublin acquisition as 1873 and cited a published statement that it arrived in a dying condition and lived in Dublin only “about five minutes.” However that may be, Dublin did have the first living Pigmy Hippopotamus.

“Jumbo,” one of the two males received in 1912, lived until February 17, 1952. The other male, “Heinie,” was sold on November 21, 1925. “Tieda,” the female, died on October 2, 1952. Ten young have been born in our collection. Three were sold, one was given to the London Zoological Society when it was eight years old, and all the others died within a year or two except one, a female, which survived for nearly 30 years and was, in fact, our last Pigmy Hippopotamus until the present two were received from the National Zoo in the fall of 1953. Their offspring, a male, was born on March 15 of this year, and has been sold to the Cleveland Zoo.

Today we take Pigmy Hippopotamuses more or less for granted and visitors are apt to pass them by with a glance or an exclamation on seeing a “baby Hippopotamus.” But in 1912 a major part of the Zoological Society’s *Bulletin* for July was devoted to two articles about the new animals, one by Dr. Hornaday and one by Hans Schomburgk, the collector for the Hagenbeck establishment who captured them and brought them to New York.

Schomburgk’s account of his adventures in Liberia is not a tame one. He seems to have been

a rough-and-ready collector and explorer who got what he wanted at gun-point, if necessary. The contrast between the lawlessness of those days and (despite the incidents currently reported in our newspapers) the civilization over so much of Africa today is striking; no collector today would think of carrying out an expedition in such a high-handed manner as Major Schomburgk did in 1912.

It will, we hope, renew interest in the rare and valuable Pigmy Hippopotamus if we reprint Major Schomburgk's article from the July, 1912, issue of the New York Zoological Society's *Bulletin*. (EDITOR).

ON THE TRAIL OF THE PYGMY HIPPO

An Account of the Hagenbeck Expedition
to Liberia

By HANS SCHOMBURGK
*Major and Military Attaché,
Liberian Legation, London*

“COME TO SEE ME AT ONCE,” was the telegram I received from Carl Hagenbeck, when I had let him know that my projected trip through the French Congo had been abandoned. I hur-

ried to Hamburg to meet our grand old man of Stellingen, who greeted me with these words:

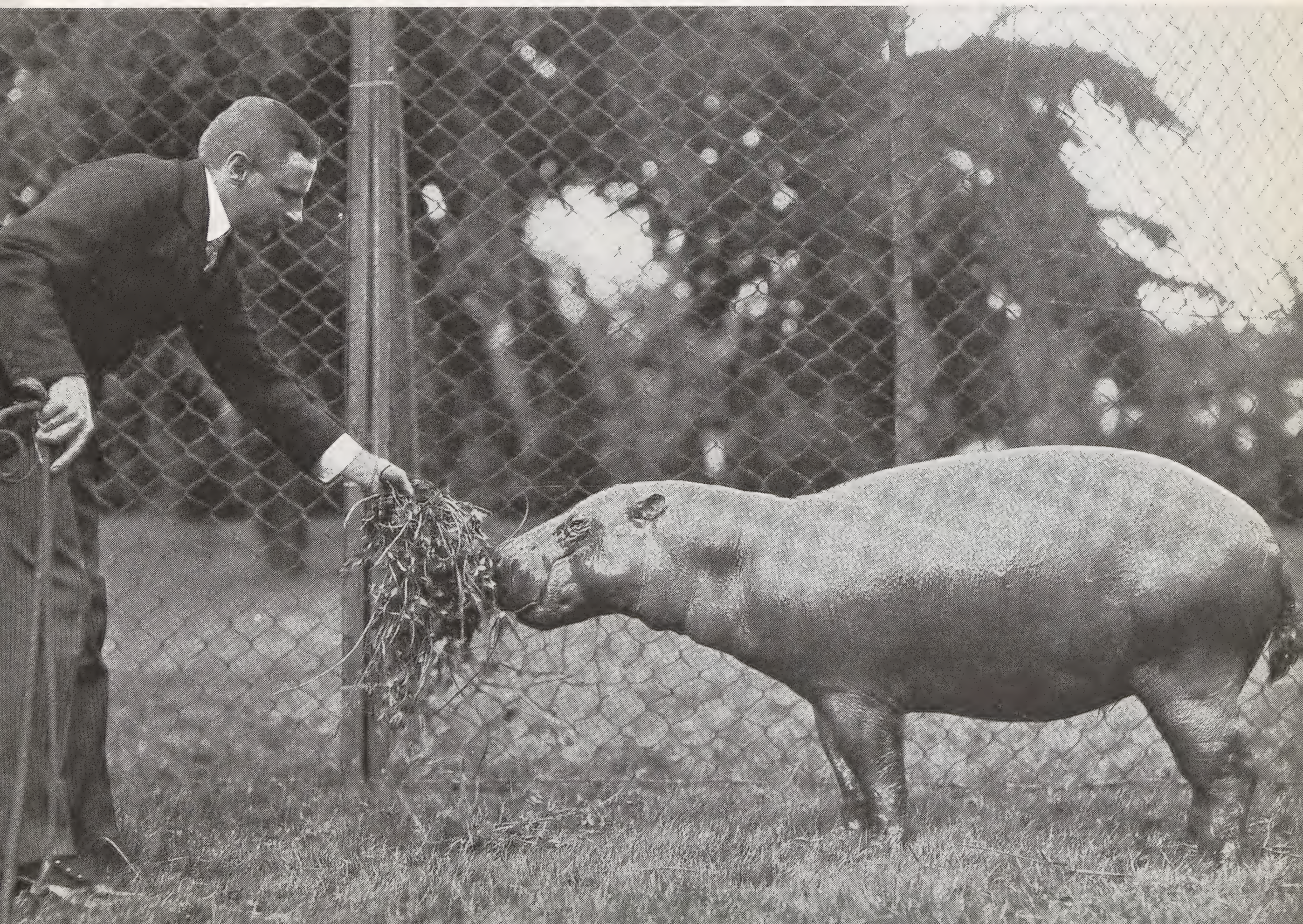
“Will you go for me out to West Africa, to try and capture an animal that has never been brought to Europe alive, and help me to preserve a dying species of the African fauna?”

“Why, certainly,” was my reply, “Have I not just equipped an expedition to go to the Western Coast?”

But when he then told me in confidence that I was to go to Liberia, capture and bring back alive specimens of the Pygmy Hippopotamus, I must confess that I hesitated. Here I was asked to catch alive an animal which had not even yet been shot by a European hunter! Prof. Buttikofer, the great authority on Liberia, had tried for years to secure a specimen, and after all he had to be content with the skins and skeletons of three animals that had been shot by native hunters, without himself even having seen a live animal.

Major Schomburgk renews acquaintance with one of our Pigmy Hippopotamuses. Our trio cost \$15,000 in 1912 and of them Dr. Hornaday wrote that “As zoological rarities they are well worth their cost.”

Photos taken in 1912



During my twelve years of African travel, my motto had been, "Nothing is impossible." I had explored the Wa Lunda country on the watershed of the Congo and Zambesi, without an armed escort, in the face of the evil prophecies of old hands who took leave of us for good when we started on our trip. I had succeeded in bringing home alive the first East African elephant, an undertaking that had been tried by many a well known hunter without success. "Yes," I said, "I will go!"

Six weeks after this conversation I landed in Monrovia, the capital of the Republic of Liberia. Here I was greeted from all sides with the assurance that no such animal as the Pygmy Hippo existed, but only the big Hippo.

Having read in Buttikofer's book that he had obtained a specimen of the Pygmy Hippo on the Duquea River, I decided to give this river the first trial. Unfortunately I arrived just in the beginning of the rainy season. With the greatest difficulty I managed to collect twelve carriers, who, on the promise of extra high wages, agreed to follow me.

In this lot, I must have found the human sweepings of the streets of Monrovia. How they humbugged me! They evidently thought I was powerless to do anything, and I knew only too well that they would desert on the slightest pretext.

In Sheffeliensville I got the first news of Pygmy Hippos. Mr. Lett, an American mulatto, who had been a hunter with the Buttikofer expedition, gave me the assurance that the Pygmy Hippo existed on the upper part of the Duquea River, while his big cousin, the "Kiboko" of East Africa, only frequented the rivers near the coast. I hired six canoes in Sheffelian to bring me up to Jah-town, six days up the Duquea River.

Rain was the order of the day. In pouring rain we started every morning, and pulled all day long against the current of the swollen river. The second day out, I thought the time had come to teach my carriers a lesson. We were so far from civilization already that I no longer feared desertion.

When I called the boys in the morning to start, nobody came; so I called up my headman, and asked him very quietly if the boys were packing up.

"No," was the reply, "they do not want to start yet."

Without saying another word I took up my Browning automatic revolver, and put seven shots through the roof of the boys' hut. Then they came quickly! From that moment I took the reins; and after I had picked out the biggest and laziest of the motley crowd, and had given him a good hiding, I had no further trouble.

After a month's hard hunting, I at last had the luck to see a Pygmy Hippo. I was drifting down the river in my canoe, late one afternoon, when I saw the animal trying to climb up the steep bank of the river. Before it had noticed us, we were within ten yards. I stood with my gun ready to shoot, but with a great effort I curbed my hunting passion. Carl Hagenbeck's last word had been: "Now, remember! We must have our animals alive! Do not shoot before you are sure to be able to catch one." Not five yards from the canoe the little brute dropped back into the water and disappeared.

Shortly after that I returned to the coast and fitted out anew to penetrate into the Golah country. Two months I hunted there without any success. In the rains it was practically impossible to find any tracks; but in spite of everything I managed to find about thirty promising places in which to dig my pits. At first I had the intention to try netting the animals, but the uncertainty of their movements, and the thick undergrowth of the dense Liberian forests, made net-hunting impracticable.

One day a Hippo fell into one of the pits. It had rained for thirty-six hours, and before my scouts reached the place it escaped unharmed! For the first time in my life, I knew myself beaten. Practically all my carriers were sick; the whole country was under water, and the native trails were recognizable only because in them the water raced down like mountain torrents.

I returned to the coast and cabled to my people that the only chance for success was in the short, dry season from January to May. The net result of this expensive expedition was that I had absolute proof of the existence of the dwarf Hippo.

But what Hagenbeck undertakes, he carries through against all odds, and without consideration of financial sacrifices. He had not lost faith in me; and in December, 1911, I started out on

my second expedition. This time I was known in Liberia, and had but small difficulties in raising a caravan of fifty good men.

I had seen on the last trip that nothing could be done near the coast, though the beasts exist even within a day of the coast; but there it is hunted too much by the natives, and is consequently too rare and shy.

The confluences of the upper Lofa River were this time my goal. Here, in the practically unknown Gorze territory of the powerful and warlike Golah tribe, near the big Sue Bush, where there is no human habitation for days and days, I could reckon on success.

But again I encountered an unforeseen obstacle. The Pesse tribe had declared war, and was fighting the Government and its allies.

Yangaia, a big fortified Golah town, I reached without any considerable trouble, but when I called my carriers the next morning to start, they rebelled, one and all. The previous day we had had a sharp march of twenty-five miles through thick bush. Instead of taking their loads the whole crowd came down to my tent, which I had pitched outside the village, and refused to go on. They said:

"We are tired to-day; and there is war ahead. To-day we will not move, for to-morrow we hold word."

This was all I could get out of them. The whole success of the expedition was in the balance. Had I made them the slightest concession, everything would have been lost. Once more I told them to take their loads, but only a threatening murmur was the answer. Then I saw red, open rebellion! I slipped the Browning in my pocket, took my hunting crop and went among them. Clash, crack went the whip on the naked

body. A few straight hits from the shoulder on the jaws of those who did not move, and quicker than I can tell it I drove the mutinous crowd before me like a herd of sheep! The result of the rebellion for the boys was that I stopped their rations for three days, and their allowance of gin for a month.

The same day I reached Taquema, the fortified town of the paramount chief of the Golah, Tawe Dadwe. I had reckoned greatly on the assistance of this omnipotent native king, but to my great sorrow he declared openly that he could not help me, because the war pressed him too hard. He even expected an attack from the Pesse daily. Against my usual custom, I had to submit to the entreaties of the chief, and pitch my tent in the middle of the town.

During my stay at Taquema the scouts of the enemy approached the town, but hearing that a white man with a big caravan and guns had arrived, they thought discretion the better part of valor. Here I had an opportunity to study the most secret sacrificial rites of this unknown tribe.

The Lofa River, one of the biggest rivers in Liberia, flows within an hour of Taquema. For two months I hunted on the small tributaries of this river, the course of which will appear entirely different from what it has been thought, when my map of the hinterland of Liberia is finished.

In spite of the greatest endeavors and the hardest work which I have done during my long hunting career in Africa, I did not even manage to shoot one of these shy and secretive animals, in order that I might send home positive proof of its existence.

The greatest difficulty in hunting the Liberian Hippopotamus is that, unlike their big cousins,

After incredible difficulties, Major Schomburgk got his first three Pigmy Hippopotamuses near this Golah town on the Lofa River. All were captured in pits.





More than a hundred pits were dug before this adult bull was caught and taken back to camp.

they do not frequent the rivers. They make their home deep in the inhospitable forest, in the dense vegetation, on the banks of the small forest streams; but, not satisfied with the protection the forest affords them, they enlarge the hollows which the water has washed out under the banks, and in these tunnels, where they are invisible from the bank, they sleep during the heat of the day.

Day after day I patrolled the streams, continually in water up to my hips, frequently to my shoulders. At last, as I was nearly despairing, on the 27th of February, Diana, the goddess of the hunters, smiled on me, and the first Liberian Hippopotamus fell a victim to my gun. It was a nearly full grown cow. I was following the spoor of a small herd of the newly-by-me discovered dwarf elephant, when a fresh track of a Mwe (Golah name for the Pygmy Hippo), made me leave the elephants. I followed this spoor down to a small streamlet with hardly two inches of water, where it led into one of the above mentioned holes. I sent my boy round, and when he started poking into the hole with a stick, a responsive grunt followed, and not two yards from me the head of the much coveted animal appeared. I still carried my elephant gun. As my shot rang through the forest, one of the rarest animals of the African fauna lay before me.

My camp was far away in the bush, and to my great regret I had to abandon the skeleton. It was only with the greatest difficulty that I managed to skin the animal and have the skin brought by my two hunters to the tent.

In spite of all difficulties, however, I had not given up the idea of catching a hippo alive.

Wherever I found a likely place I had a pit dug. It is easy to catch the great East African Hippo, which keeps continually in the same water and uses the same tracks. With the Pygmy Hippo, it is very hard to even find a place where there is the slightest chance of catching one, because this brute roams through the forest like an elephant or a pig, mostly goes singly, though sometimes in pairs, and rarely uses the same track twice.

Meanwhile over a hundred pits had been made by my men, all carefully dug seven feet deep and covered so that not the sharpest eye could detect any sign of danger.

At last, two days after I shot my first animal, and when I was still working on its thick skin, a boy rushed to my tent breathlessly shouting from afar:

"Massa! Massa! Dem Mwe done catch!"

On Nea Tindoa, an inhabited island in the Lofa River, a big bull had fallen into one of my pits. My sergeant, Momoro, started at once with a few boys, to reach the place the same night, and keep guard to prevent the meat-hungry natives from killing the Hippo.

At last I had succeeded! Against the prophecies of Europeans, Liberians and natives! And only a few days before, Tawe Dadwe told me: "It is impossible to catch a Mwe! It has never been done, and they have only been shot after they have been caught in the pits. They are too dangerous. Many a hunter has been killed. You white men know a lot, but here you are trying something that is impossible."

Early the next morning I reached the place. Before night a fence had been built around the hole, and the animal was let out. It was a beautiful full-grown bull, in the prime of his life.

Nothing succeeds like success! Six days after that, the second one was caught; this time a two-year-old cow. A week later, the third, a young three-quarter-grown bull was taken. Now I had three animals, at three different places. Macca, where the little cow was caught, I decided should be my central collecting station; and we started to bring the animals there.

Now the real trouble commenced. The Golah people refused to carry them! For the big animals, I needed at least forty men each, to cut roads and carry.

Had it not been for the unselfish assistance I

had from the Liberian Government, which had appointed me Major on the Geographical Staff, I never would have been able to bring my expedition to a satisfactory end.

Nobody can imagine the enormous difficulties of the transport of those heavy animals, which we had to carry in self-invented native-made baskets, through the roadless hinterland of Liberia. From the farthest place inland, where I caught three animals, it took me, even after the men had cut the roads, twelve days to reach the first river on which I could use boat-transport to the Coast.

A native king, Gongzoo, had, on the promise of a big present, promised carriers for the first animal caught in his district, but when I asked for the men, he point blank refused! By that time I had put the Hippo in a basket, and had brought it with my own carriers, under the most frightful difficulties, to his town. It was a matter of getting men from him, or standing the chance of losing my hard-won animal.

I tried a bluff, with only my sergeant for support. I arrested the chief in the middle of his own town, kept him in front of my revolver, loaded all my guns, put them before me on the table, and declared war provided the men were not forthcoming within two hours. It succeeded. When the people saw their king a prisoner, the men came. What would have happened if they had accepted my challenge, I do not know!

After I had got the first three animals to my central station, and handed them over into the charge of one of Hagenbeck's most experienced keepers, I returned to Monrovia, to arrange all about the further transport, and to meet my wife, who had come out to join me, and to put the experience which she had gained during an eight-months horse-back ride through the hinterland of the Cameroons, into the services of Hagenbeck.

Shortly after we had returned to Macca, another big bull and a youngster were caught; and then it was high time to return to the coast, before the rains should set in and make the country impassable. His Excellency, President D. E. Howard, very kindly put soldiers at my disposal, to assist me in collecting sufficient carriers.

After I had managed to tame a full-grown Mwe, the natives feared me so much that I succeeded in collecting 150 men in three days. While Mr. Moltmann, the keeper sent by Hagenbeck,



The carriers put on a burst of speed — for picture purposes — while carrying the capture out.

and I hurried ahead to arrange for the food for the animals, Mrs. Schomburgk superintended the transport, as it was absolutely necessary that one European should keep an eye on the carriers so that they did not drop the heavy baskets on the uneven and partly-mountainous trails.

At last we had reached Japacca, and could put our poor, ill-treated animals into proper cages, which had been sent out from Hamburg.

Now our greatest troubles were over. The animals were in good condition and feeding well, so that we could expect to get them safe to Hamburg. But another trouble arose. When we got to the coast at Cape Mount, we were prophesied a bad sea for the first of June, the day the steamer *Alexandra Woermann* was to call for us. But even then our luck did not desert us. Certainly with difficulties, but without mischief, we shipped our valuable cargo. In the Bay of Biscay we had stormy weather. The ship rolled heavily, but the animals did not seem to mind it.

The enormous expenses of these two expeditions can easily be imagined when one considers that in Liberia everything has to be carried. Great quantities of trade goods are necessary to procure food for the carriers, and also as presents for the native chiefs.

Fortune has again been kind to Hagenbeck's colors. For forty years attempts had been made to bring these animals to Europe; and we had succeeded. The greatest satisfaction to me, however, was when I had the honor to be presented by Mr. Hagenbeck to His Majesty Kaiser Wilhelm II, when he visited Hagenbeck's Animal Park, at Stellingen, on the 17th of June, where he congratulated me on my success.



OUTPOST OF THE ZOOLOGICAL SOCIETY

THE MOST FAR-FLUNG OUTPOST of the Zoological Society is undoubtedly a tiny, tin-roofed hut in the Kayonza (Impenetrable) Forest of Uganda. Primitive as it appears in the photograph, it is well adapted to its purpose — a headquarters for the study of gorillas, chimpanzees and various small monkeys. It even has a name: The Makerere College-Osborn Camp for Primate Research.

The camp came into being as a direct result of

President Fairfield Osborn's tour of central Africa in the late winter. Discussing with Dr. Niels Bolwig of the Department of Zoology of Makerere College at Kampala, Uganda, the need for continuing and expanding primate research in the area, Dr. Osborn learned that the college wished to set up a camp in the excellent Mountain Gorilla country in the Kayonza, but had no funds for the purpose.

Dr. Osborn immediately offered, from the resources of the Madison & DeForest Grant Scientific Research Fund, the small sum necessary

The "Makerere College-Osborn Camp for Primate Research" was only half finished when this picture was made earlier this year but it was quite adequate for purposes of research.

to build a shelter hut. Subsequently Dr. Bolwig and George B. Schaller chose the site and while Mr. Schaller continued his gorilla studies, Dr. Bolwig superintended construction of the hut. It is 10 x 12 feet in dimensions, and has a slate floor. At the time the photograph was taken the walls had not yet been plastered with cement.

"It is not very impressive, but I hope useful," Dr. Bolwig wrote. "George seems to think it is a nice hut. Around the cabin are a few rose bushes and lemon trees which were planted years ago by a prospector."

Regulations concerning the use of the camp have been drawn up by Makerere College. They state that "The study of habits, troupe composition, wanderings, etc., of gorilla and chimpanzee has first priority. The comparatively small number of gorillas in the limited area will make it possible to follow the fate of each individual over the years.

"Second priority must be given to any field work with a bearing on the life of the gorilla, such as the study of vegetation, particularly food plants, micro-climate, etc.

"Third priority should be given to the study of smaller monkeys, particularly the varieties of *Cercopithecus mites*."

The camp represents a very small outlay (less than \$200) but, as with so many other judicious expenditures, it will exercise an influence on the study and preservation of African animals far beyond the money value of the installation.

News from the Conservation Foundation

Colorado College Conference

Because opportunities for improving conservation and resource-use education in our schools and colleges have been steadily increasing during the past two years, it has become evident that there is need for a project to develop guide-lines for conservation and resource-use training programs.

To meet this responsibility a conference was held under the leadership of the Joint Council on Economic Education and the Conservation Foundation at Colorado College, Colorado Springs, from Sept. 30 to Oct. 3. The participants were a selected group of conservation leaders whose aim was to develop and distribute a publication that will help to guide teachers in this field, both as to content and method. Paul Brandwein and George Brewer represented the Foundation and the Joint Council was represented by Dr. George L. Ferish.

Scottish Natural Resources

Acting under the good offices of Frazer Darling, Vice-president of the Foundation in charge of research, a Committee on Natural Resources in Scotland has been set up by The Scottish Council. Its objective is to form a fact-finding study group on natural resources (including human resources) and to make recommendations.

The meetings, to be attended by both Dr. Darling and Wallace Bowman of our research staff, will begin on Oct. 31 in Edinburgh. A paper by Mr. Bowman, "Outdoor Recreation Potential as a Natural Resource," will be presented.

African Ecological Survey

Further evidence of the scope of the Foundation's activities was highlighted in September when the Rockefeller Foundation granted the sum of \$7,500 for an Ecological Survey of the Mara-Mau region in Kenya, East Africa. This grant augments an earlier one of \$5,000 provided by the Conservation and Research Foundation, Inc., of New London, Conn. The Conservation Foundation will undertake the pub-

lication costs of the survey when completed.

This survey, conducted by Dr. Philip E. Glover, one of the foremost ecologists in Africa, will study the Mara-Mau area of the Masai Territory, much of which is suffering from inimicable land-use, mainly over-grazing by domestic cattle, and, in the northern area, by forest destruction. The survey will develop basic data concerning land conditions in this important region.

EBF to Distribute Filmstrips

Arrangements have been concluded between the Foundation and Encyclopaedia Britannica Films, Inc., to distribute the color filmstrips "Demand — Supply — Balance."

These will be released for three grade levels: "Natural Resources and You" for the middle grades; "Using Natural Resources" for junior high school; and "Science and Natural Resources" for the senior high school.

Briefly Noted

Dr. Osborn gave a talk before the Overseas Press Club on Aug. 23, entitled "Where Are People and Animals Going?". . . . On August 16 Roger Hale attended a subcommittee meeting on development of a Pest Control Manual at the National Academy of Science in Washington. The subcommittee is under the direction of the Committee on Pest Control and Wildlife Relations. . . . Fraser Darling's new book, "Wild Life in an African Territory," will be published by the Oxford University Press in October. . . . On Sept. 7 Samuel Ordway, Fraser Darling and Wallace Bowman held informal discussions with several staff members of the University of California at Berkeley concerning needed research in the field of recreation. . . . Dr. Osborn addressed the Constitution Island Association on Sept. 10, speaking on the general topic of rivers. . . . The Fifth World Forestry Congress, held in Seattle from Aug. 29 to Sept. 10, was attended by Dr. Darling, who gave a public lecture on "Wild Life Behavior in African Game Parks".

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

“The Care of Pet Turtles”

Stapled into this issue of *Animal Kingdom* is the latest booklet published by the Zoological Society, “The Care of Pet Turtles” by Dr. Hernon G. Dowling, Curator of Reptiles, and Stephen Spencook, Head Keeper of Reptiles. It may be extracted from the magazine by removing one staple.

The new booklet takes the place of “The Care of Turtles and Small Alligators” by Director Christopher W. Coates of the Aquarium, first published in 1941 and subsequently thrice reprinted. It is now out of print.

A series of booklets on the care of small pet animals is planned, each to be written by a member of the curatorial staff.

“The Care of Pet Turtles” is available separately for 25 cents from the Publication Office, The Zoological Park, New York 60, N. Y.

The Staff Travels

In recent weeks the staff of the Zoological Park and the Aquarium has attended a variety of meetings and conferences across the country.

Associate Director Conway of the Zoo and Director Coates of the Aquarium went to the meeting of the American Association of Zoological Parks and Aquariums in Long Beach.

Mr. Conway and Curator of Reptiles Dowling were present at the official opening of the Holland Museum of Living Reptiles in the Detroit Zoo.

Dr. Dowling and Dr. James W. Atz, Associate Curator of the Aquarium, attended the meeting of the American Society of Ichthyologists and Herpetologists in Chicago.

Dr. Charles P. Gandal, the Zoo's Veterinarian, was elected president of the American Association of Zoo Veterinarians at the Denver meeting of the American Veterinary Medical Association.

Staff Photographer Sam Dunton took part in the meeting of the Biological Photographic Asso-

ciation at Salt Lake City where one of the Society's films, “The Locomotion of Snakes,” won the second award. He presented a paper on “Biological Photography in a Zoo Hospital.”

Dr. Ross Nigrelli, the Aquarium's Pathologist, attended the meeting of the American Fisheries Society in Denver to advise on a serious outbreak of liver tumors in trout.

IN BRIEF

Shark Scare. Two shark attacks off the New Jersey coast in the late summer brought a flood of telephone, newspaper, radio and television inquiries to the Aquarium, with Director Coates making several television and radio appearances to talk about sharks in general and to allay the public's fears. Although not underestimating the danger of sharks, the Aquarium learned from local fishermen that there were probably no more sharks than usual in local waters. Nineteen kinds of sharks are reported from the metropolitan waters, inshore or offshore, and seven are considered dangerous or potentially dangerous — the White Shark, or Maneater; the Tiger Shark, the Great Hammerhead, the Dusky Shark, the Whitetip Shark, the Blue and the Mako Shark. Nevertheless the number of shark attacks in proportion to the number of “bather hours” on the Jersey and New York coasts indicates that the chances of being attacked are very small indeed. One shark was brought to the Aquarium for identification. It proved to be a Sand Tiger Shark — whose name is more fearsome than its reputation. There are no records of it attacking human beings in nature.

Air Conditioning for Animals. New York summers are notoriously hard on people — and, as the Zoo staff knows, on certain animals. Increasingly in recent years we have installed air conditioners in the animal buildings and they are

This portrait of our Okapi baby was taken in mid-September, just before it was 11 months old. The youngster appears to be in perfect health — fat, sleek.



now making the hot days and nights more comfortable for the Takin, Bushmasters and certain other snakes, the Tuatara and various amphibians, hummingbirds, sunbirds, puffins and penguins.

Bathysphere on View. After being in storage for a great many years in the Zoological Park, the original Bathysphere in which Dr. William Beebe and Otis Barton on August 15, 1934, descended to a depth of 3,028 feet in the ocean off Bermuda has been put on exhibition at the Aquarium. The New York Zoological Society's Department of Tropical Research made repeated dives in the Bathysphere between 1930 and 1934 in a pioneering effort to open the depths of the sea to scientific exploration — an endeavor in which it was spectacularly successful. Much deeper dives have been made by many since then but in 1934 the 3,028-ft. dive was the greatest depth reached by man up to that time.

New Film. A new one-reel motion picture, primarily for veterinarians, has been produced by the Society. Entitled "Surgical Removal of Subcutaneous Tumors in Parakeets," it describes techniques successfully employed by Dr. Charles P. Gandall.

Research Grant. Dr. Nigrelli, the Aquarium's Pathologist, has received a grant of \$10,800 from

the Damon Runyon Memorial Fund for "Studies on Sponges with No Apparent Ribonucleic Acid." Up to now it has been assumed that ribonucleic acid is one of the basic building blocks of all living organisms and that no plant or animal is without it. The report that certain Bahamian sponges lack this substance is so exceptional that its significance is far from understood. Dr. Martin F. Stempien, a biochemist from Cambridge University, is working with Dr. Nigrelli on this fundamental problem.

\$615 Worth of Snakes. Forty-one African Rock Pythons have hatched in the Reptile House after the eggs were removed from the guarding mother, and the snakelings are being used in exchange with other institutions. A value of \$15 each has been placed on them for exchange purposes.

Mrs. Martini Retires. Mrs. Helen Martini, since 1944 in charge of the Zoo's Animal Nursery, retired in August.

Design Laboratory. The Curators of the three animal departments have set up a "design laboratory" in the northwest corner room of the Lion House for experimentation with new materials, new uses for old materials, new lightweight decorations and the like, and to build models in order to guide the actual construction of exhibits.

PUBLICATIONS OF INTEREST

ALL ABOUT FISH. Written and illustrated by Carl Burger. Pp. ix + 140, many illustrations in color and black-and-white. Random House, New York, 1960. \$1.95.

Carl Burger should be well known to many of his fellow Members of the Zoological Society — but as an animal illustrator, rather than a writer-illustrator, for this is his first book. And an excellent, easy-to-read book it is, starting with the first chapter on "What Is a Fish, Anyway?" and right through the beginnings of fish life, tales of sea serpents and monsters, the oddities of fish life, and chapters on saltwater and freshwater fishes, those that live in one kind of water and breed in another, the coral reef beauties — and even "Fish for Dinner," "Fish as Pets" and (naturally, since Mr. Burger spends his spare time fishing trout and salmon streams) "Fishing for Fun." This is the kind of book that I, at least, have been waiting for to recommend to young people searching for a career in the natural history fields. — W. BRIDGES

ANIMAL SPECIES AND THEIR EVOLUTION. By A. J. Cain. 190 pp., 5 figs. Harper Torchbook. Harper & Bros., N. Y., 1960. \$1.35.

All evolutionists follow in Darwin's footsteps, but in a very special way this book begins where the *Origin of Species* left off. It discusses the principles of classification, defines the species as understood both yesterday and today, and shows how important the study of evolution is to the definition of that category. The reader is assumed not to have any previous knowledge of the subject, but he must be willing to apply himself. — J. W. ATZ.

AUSTRALIAN SHELLS WITH RELATED ANIMALS LIVING IN THE SEA, IN FRESHWATER AND ON THE LAND. By Joyce Allan. xxi + 487 pp., 12 color and 32 black-and-white plates, 112 text-figures. Charles T. Branford Co., Newton Centre 59, Mass., 1959. \$12.00.

More than 100,000 different kinds of snails, clams, octopuses and their relatives are alive today, and approximately 10% of these inhabit Australia and the surrounding waters. This volume is concerned with the identification and natural history of some 2,000 of the better known or most representative species. It is copiously illustrated by the author and has indexes and a glossary. — J. W. ATZ.

COWRY SHELLS OF WORLD SEAS. By Joyce Allan. x + 170 pp., 6 color and 9 black-and-white plates, 1 text-figure. Charles T. Branford Co., Newton Centre 59, Mass., 1956. \$10.50.

Among the most beautiful shells in the world are the cowries whose highly polished surfaces and rich but never gaudy coloration have earned for them a special place in the hearts of both amateur and professional conchologists. Miss Allan has described all of the true cowries, as well as their close relatives, and she has illustrated many of them. Natural history notes are included, but this is primarily a manual for the collector. — J. W. ATZ.

REPTILES: LIFE HISTORY, EVOLUTION, AND STRUCTURE. By Angus d'A. Bellairs. 192 pp., 12 text-figs. Harper Torchbooks, The Science Library, TB 520, 1960 (reprinted). \$1.35.

The British seem to be peculiarly able to compress large subjects into a few pages and to still emerge with an easily readable work. It is a distinct pleasure to welcome this little volume in a paperback edition. First published in the Hutchinson's University Library series in 1957, it brings together information on reptiles much as G. K. Noble's "Biology of the Amphibia" (1931) did for the next lower vertebrate class. The figures are rough outlines for the most part and are too closely grouped on a page to be aesthetically pleasing. They serve their primary purpose, however, in clarifying points in the text. A well-rounded, though abbreviated, bibliography completes the book. — H. G. DOWLING

New Members of the New York Zoological Society (Between July 1 and August 31, 1960)

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Walter Rothschild

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Mrs. Edward Clarence Dean

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Charles W. Nichols, Jr.
Dr. Dominick J. Principato

Contributing

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Arthur Sussman
Joseph A. Tramazzo
Matteo Verdillo
Mrs. Henrietta V. Vogt
Martin Winter
Miss Margot Young

Late News from the Albert National Park in the Congo

JUST AS THIS ISSUE of ANIMAL KINGDOM was going to press, President Osborn received a letter from Dr. Niels Bolwig of the Department of Zoology of Makerere College, Uganda, giving news of the situation in the great Albert National Park in the Congo.

In view of the disturbed political situation in the Congo, zoologists and conservationists have been worried about the fate of the National Parks, particularly the Albert which has been under intensive scientific study for so many years. Dr. Bolwig's report, brief as it is, is encouraging.

Extracts from his letter to Dr. Osborn are published here, in space usually devoted to our Membership Department's communications to our Members, because the body of the magazine had gone to press when Dr. Bolwig's letter arrived. — EDITOR.

FROM DR. NIELS BOLWIG

"Things seem to go very well in the Albert National Park. Dr. Verschuren, the biologist, seems to have shown much courage and contributed much to save at least the southern part of the park. From here [Makerere College] we proposed to help the park until UNESCO could step in. The proposal . . . turned out not to be necessary. The money was apparently there and

the main difficulty was to get it to the Congo. President du Conseil Miruho for the Kivu Province has taken interest in the park. He has appointed a warden, Mr. Anezi, and three men from IRSAC [Institut pour la Recherche Scientifique en Afrique Centrale] to go over once a week to instruct the staff of the park.

"Mr. Miruho has written to the Uganda National Parks and myself expressing the hope that he will be able to run the park satisfactorily and keep it open to tourists and research workers as before.

"The IRSAC Laboratory is still working and most of the male staff is still there. Their difficulty is, I believe, petrol and they find it almost impossible to collect material.

"Dr. Itani is still in the Impenetrable Forest. He lives in the hut [the hut pictured on page 180 of this issue]. Now I hope we shall make good use of it."

* * *

On receipt of Dr. Bolwig's letter, President Osborn wrote to Mr. Miruho expressing the New York Zoological Society's great satisfaction in learning of his personal interest in the National Parks, and offering the Society's aid in any way possible in the cause of Park protection.



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THE MAGAZINE OF THE NEW YORK ZOOLOGICAL SOCIETY

ANIMAL KINGDOM

Bulletin of the
New York
Zoological Society

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Our Turning-point

THIS BEING THE YEAR'S END, it is very much in order to express thanks to the growing number of the Society's Members and friends for their belief and support. It has been a satisfactory year, with attendance of some three million visitors at the Zoo and the new Aquarium. Encouragingly, the Aquarium is steadily gaining in popular interest. During the year the Society has been doing its utmost to carry forward its other activities—wildlife protection, scientific research and education.

However, it is now becoming abundantly clear that the immediate future will be, in many respects, a turning-point in our history. It is imperative that we substantially strengthen our financial resources if we are to take advantage of the innumerable opportunities that lie ahead of us. Many of our exhibition buildings are antiquated. We have prepared a number of plans that will use new techniques for exhibiting our superb collections of animals in natural settings—for the benefit of the animals themselves as well as for the increased enjoyment of the public.

In common with all institutions today, our basic operating costs are rising. Unless we meet the urgent challenge of substantially adding to our resources, our Society is bound to retrogress from its position of leadership—in its services to the "animal world" and to the public. The lead article in a forthcoming issue of this magazine will endeavor to express why this statement is true, and to define the goals that must be reached.

Meanwhile, happiest Season's greetings.

Fairfield Osborn

AMERICAN MUSEUM OF NATURAL HISTORY

Ducks Lay Them—We Hatch Them!

By WILLIAM G. CONWAY

Curator of Birds

IT IS A BIT FAR-FETCHED to imagine that you might have heard the first low calls of an unhatched Laysan Teal duckling, one of the world's rarest birds. But, peering through the double glass portholes of a Bronx Zoo research incubator last June 28, a group of "bird men" were doing just that—listening and watching the first "New York" Laysan Teal duckling-to-be.

After three years of careful experimentation, the Zoo's new waterfowl breeding program has come of age.

Waterfowl of South America, Asia, Europe and Africa, as well as North America, have all been represented by eggs in our incubators during the past season. We always feel gratified when a collection reproduces itself well, for it is a good indi-





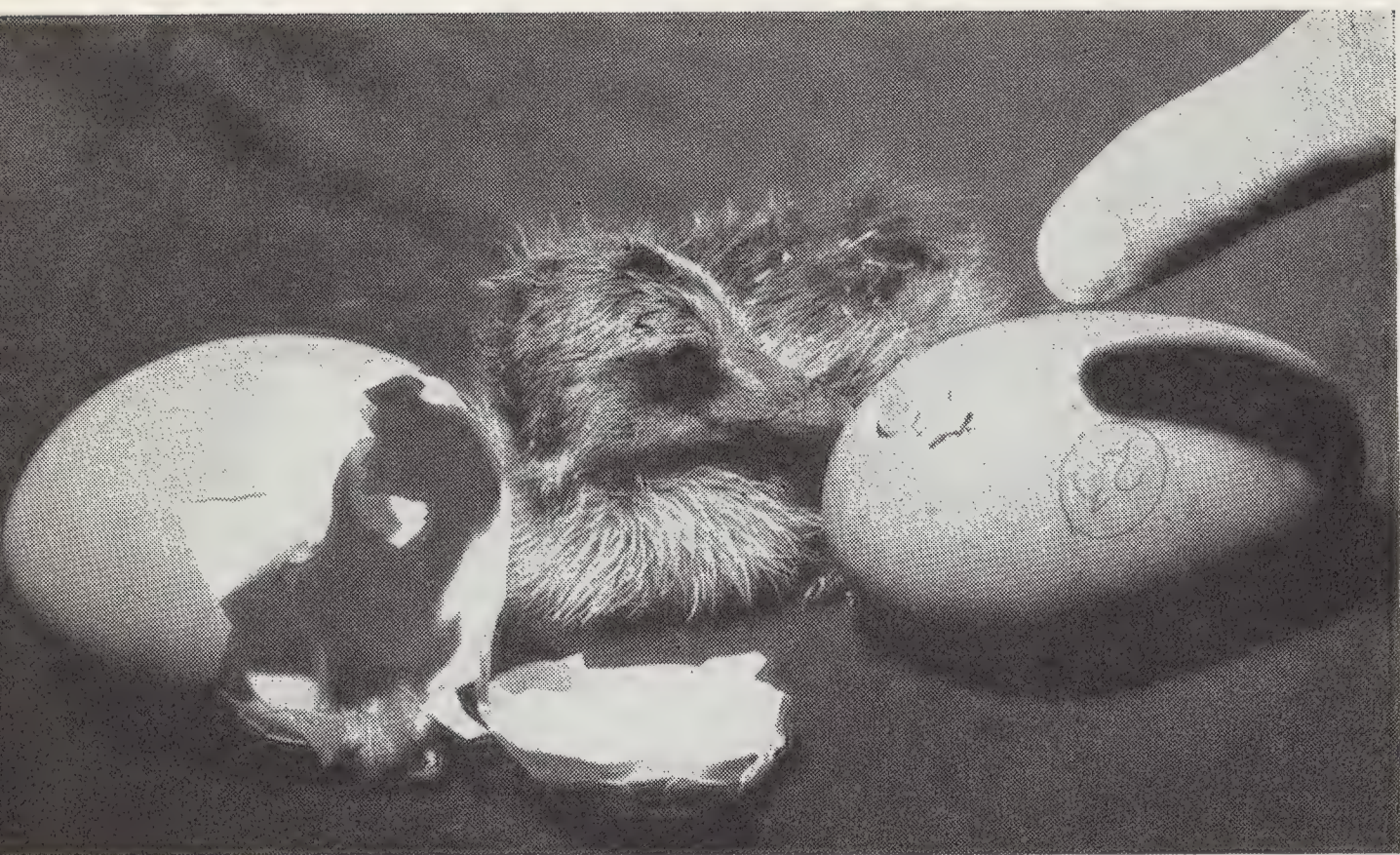
Headkeeper of Birds Bell (foreground) and Assistant Headkeeper Winnegar spend much time at the brooders feeding the ducklings.

'Egg Log' in hand, Curator Conway checks its entries against trays of eggs of various species in one of the Zoo's forced-air incubators.

cation that our creatures are well established and well cared for. Besides, a successful bird-breeding program presents us with opportunities for research on little known courtship and nesting behavior.

In the Zoo, at least, there is no question about one thing — the duck comes first, not the egg. Moreover, the more ducks and drakes, geese and ganders, and pens and cobs of each species, the more likelihood of ducklings, goslings and cygnets. Breeding wild species, and especially wild waterfowl, is an amazingly complex business. Consider the first breeding of the dainty little Siberian Red-breasted Goose, a goose scarcely larger than a mallard, of striking black, white and vivid chestnut coloring, and related to our North

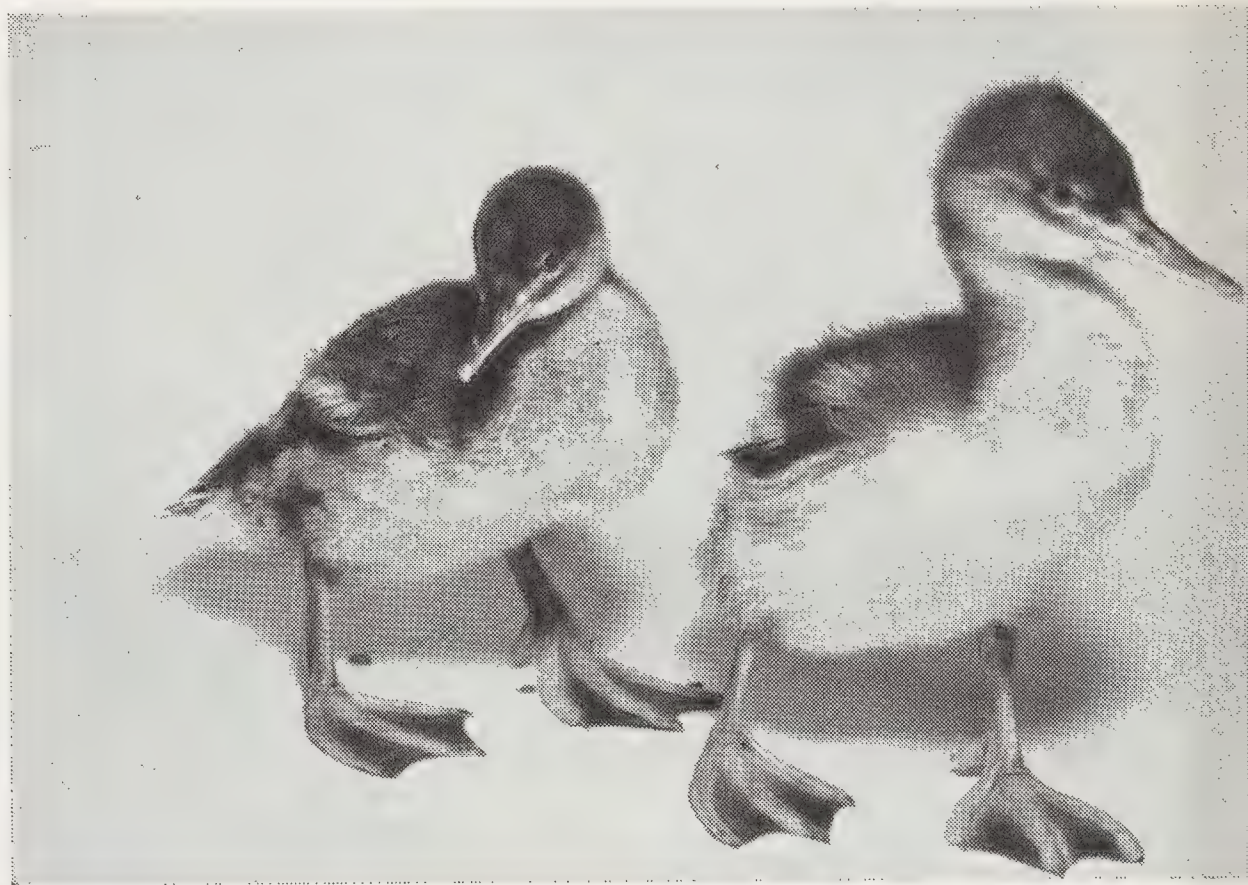
American Brants. The Duke of Bedford managed to obtain several many years ago, but it was not until he had kept them for fifteen years at his great Woburn Abbey Park that one pair finally nested, in 1926. Young from this pair, and their progeny, bred fairly readily and were well distributed to Zoos, but, interestingly enough, we know of no further record of wild-caught adult Siberians breeding in captivity, though in recent years many have been imported. For reasons which are not well understood, wild-caught adult waterfowl often fail to reproduce in captivity for many years, even under the best conditions. All too many wild-caught female waterfowl, especially geese and swans, never breed. Curiously, captive-reared birds, even though shipped abroad and subjected to varying latitudes and surroundings, may be expected to reproduce well, and wild-caught adult males usually show little reluctance to find mates among captive-bred females. Birds from eggs laid in the wild but hatched and reared in captivity reproduce just as well as captive-bred waterfowl, of course. In any event, a waterfowl rearing program should have a good



number of each species it wishes to rear. I know it sounds unscientific, but sometimes birds we propose to pair just don't seem to like each other, and they should have some choice. This is especially true of geese. We have, in fact, a European White-fronted Goose for which we have unsuccessfully provided several perfectly presentable (to us, at least) ganders. Each season Madam White-front strides purposely off into the nesting area, fashions a nest, lays six or seven infertile eggs, and faithfully incubates her fancied family alone. Some years ago, this bird was paired to an Eastern Canada Goose gander and produced some very ugly hybrids. Geese usually mate for life and it is not impossible that the involved and lengthy pairing procedure has significant, long-lasting effects on future mate choices if the first mate is lost. Some might say our White-front is being faithful to her first mate, but Waterfowl Keeper Patrick Clarke, wise in the ways of geese, keeps a suspicious eye peeled for visiting Canada ganders on Wildfowl Pond in the spring.

IF WE WANT to follow a waterfowl breeding program through the year at the Zoo, we must begin, not in May or June, but in October or November. By this time most species have assumed their brightest colors and the first tentative duck courtship displays and pairing ceremonies may be seen, for, unlike geese and swans, many ducks court mates anew each year. This is *the* time to come to the Zoo to see waterfowl, especially on warm days sometime between November and April, as they whistle, growl and posture. Miniature teal and elegant Mandarins, symmetrical widgeons and grotesque shovellers, all

move about in purposeful little groups, twisting and turning and precisely posing every feathered ornament like tiny clippers with too much sail. And they are purposeful, instinctively so; each drake's careful head bow and expanded crest, sudden arching dance figure and strangely presented contour, toward females, is quite fixed and hereditarily determined. In fact, the displays of some birds, and especially of waterfowl, are so characteristic that knowledge of them has been helpful in determining the inter-relationships of many species in the same way that knowledge of ana-



tomical structure has guided us. In a mixed collection at a Zoo, however, the courtship period becomes a time for keepers to maintain a watchful eye on the developing relationships among the collection, for mixed-matings, under captive conditions, where closely allied species of different lands are kept together, frequently occur. At the Zoo we must maintain pure wild species, and whenever a misalliance appears imminent, the call goes out for hip boots and nets and a new alignment of birds must be arranged. Wildfowl breeders have not always been so careful and today it is very difficult to find good captive-bred representatives of certain pheasants and junglefowl. It is only fair to note that waterfowl misalliances may usually be blamed on the females, which, in final analysis, usually do the real selecting of mates here, as elsewhere. Still a further problem, best met in late fall, is arrangement of waterfowl so that duck and drake are not closely related. While, in domestic animals, special characters are developed by the use of selected, closely related stock, it is the duty of the breeder

of wild species to maintain, as well as he can, the great "gene pool" of the wild population in his collection. The variability of wild populations and the natural processes of selection which may be lost in small captive groups are problems the wildfowl breeder constantly faces. Thus we try to exchange breeding birds from time to time with other Zoos, and to develop large groups of specially interesting or endangered species.

Soon, usually by January, we find certain ducks following or being followed by certain drakes, and we can form an idea of what the nesting season may bring.

Then nesting boxes are prepared and repaired, and innovations considered. One innovation in 1959 was a series of small (20") quonset-hut-shaped nest shelters of camouflaged concrete. They were highly successful and are fondly called "bomb shelters" by the Department's staff. Wooden hutches, deep boxes, special baskets and even artificial nest mounds are all used, but the most important nest shelter by far is the plant cover of the ponds. Anyone who has tried to attract birds to his backyard or woodlot knows he cannot expect a catbird to nest in a wren house, or a woodpecker in a bush. Some birds, well established in collections, are remarkably tolerant, but the best results are obtained when we are able to provide a substitute marsh for a

marsh-loving species and an open area for a tundra inhabitant. In just two years, after we transformed a barren pond into a captive exhibition marsh with dense marsh grasses, islands, fallen stumps and logs, a display was developed where such valuable species as Black-necked Swans and Laysan Teal, Ashy-headed Geese and Bahama Pintails, all bred during their first season.

Winter brings one surprising obstacle to successful waterfowl breeding which keeps the entire Bird Department staff seeking solutions between October and May: the legions of "voluntary" waterfowl exhibits which visit our ponds. Migrant ducks find Zoo lakes delightfully free of hunters and full of food. At first we were inclined to welcome these "free-loaders," but soon found that big, aggressive Mallards and Black Ducks were not only tripling our food bill, but also preventing many of our smaller, delicate, exotic birds from eating. If they were allowed to stay on, in the spring they appropriated nesting sites and even drove out and attempted to kill some of our rarest birds. We have tried all sorts of frightening devices, even a recording of alarm calls, but certainly the most spectacular of these unsuccessful ventures resulted when we put up a vast network of flapping rags over one pond. The scene was somewhat reminiscent of wash-day in a tenement district, but the wild ducks soon accepted it and dropped in for meals as usual. A final solution to this strange situation of too many ducks is not yet in view, but should you visit Wildfowl Pond this winter and a khaki-clad man bursts forth from the bushes toward the pond, screaming wildly and banging two garbage can lids — he probably works here!

Of course, when it is winter in North America, it is summer south of the Equator. While air-conditioning and central heating, not to mention jet aircraft, make these differences in seasonal time or space of reduced importance to John Doe and Pedro Alvarez, it makes a great deal of difference to North American Blue-winged Teal and South American Magellan Geese.

WHEN OUR northern species leave their breeding ranges to winter south in warmer climes, summer is approaching the Southern Hemisphere, permitting its great waterfowl population to leave the wintering grounds and to rear families further



Top — It took about 18 hours for this European Eider to emerge from its shell, and another is starting the process. Center — Hand-reared and sturdy, two Red-breasted Merganser ducklings are from eggs imported from Iceland. Above — Quite unafraid, a Barrow's Golden-eye nestles for a picture. Incubator ducklings often "imprint" on their caretakers.

south. Consequently, it is not too surprising that a Southern Hemisphere duck, goose or swan may appear to become confused and attempt to nest in the dead of a New York winter — not surprising, that is, until we begin to analyze this behavior. Black Swans and Cereopsis Geese from “down under” and Black-necked Swans from southern South America are among the most frequently “confused” species, but many other birds, including New Guinea’s renowned Birds of Paradise, come into breeding condition according to Southern Hemisphere seasons even after many years in New York. Until recently we looked to increasing periods of day length, to temperature changes, even to the position of the sun, for the sources of avian time cues. How does a bird know what season it is, anyway? There is little doubt that seasonally varying conditions are important in guiding bird breeding and migration schedules, but recent research has indicated, improbable as it seems, that some birds have an extraordinarily accurate “internal clock” which may guide their behavior in lieu of and, at the Zoo, even contrary to environmental cues. Thus, despite the obvious bitter cold of winter and its shortened days, certain of our southern waterfowl seem instinctively dependent upon their own incredible, little understood, timing mechanisms year after year. They set up housekeeping amidst the snow, which generally induces in us the hurried preparation of an incubator, and creates a feeling of awe in the face of an unlearned mechanism, a “sense” developed far beyond the ken of man. Yet it may be that the actual setting of the internal clock is not unlearned, but a result of cues associated with hatching time and early development within the lifetime of the individual, for some southern forms, reared through one subterfuge or another in a northern summer, seem more ready to follow their adopted climate’s breeding season when they attain adulthood.

March opens the long-awaited breeding season, nest shelters are hastily placed, last-minute expeditions dispatched to chop great clumps of marsh grasses from the still-frozen soil of distant bogs, and duck “loafing” logs are carefully arranged to break up expected nesting territories. Observations are trebled and incubators given careful temperature and humidity tests. Then a parade of keepers, waterfowl enthusiasts every

one, begins dropping by Head Keeper Bell’s office and the laconic reports come in: Jim Bardsley saw that pair of Cape Teal prospecting on Marsh Garden’s south island, Bob Edington says the White-eyes on Heart Lake are apartment-hunting on the point, Joe Selesky saw the Mandarins inspecting the box in the Phipps Cage.

And, with April showers come eggs — 144 of them last April! May brought more than 180, but by June the peak of the season was past with less than 100 recorded.

It always seems a bit surprising that such streamlined, modern-appearing creatures as birds follow the old reptilian egg-laying custom at all; even some reptiles have partially abandoned it. But, after all, birds are really far from modern and many present-day forms were well established before our ancestors had decided to stand up. The largest of all eggs, of course, was that of the extinct Roc or Elephant Bird, a great flightless bird which once inhabited Madagascar. Amusingly, the first two shells were discovered when natives brought them to a trading post to have them filled with rum. They had a capacity of more than two gallons. Examples have been found measuring as much as 13½” by 9½”. A modern Ostrich egg may be 9 inches long and is capable of holding, for example, the contents of 18 chicken eggs, while the eggs of certain hummingbirds measure scarcely ¼” long.

After considerable experimentation we have found it best to remove eggs from our waterfowl nests almost as rapidly as they are laid. When the first egg of certain rare species is collected, we offer the bird a plaster-filled egg as a substitute. This helps prevent her from abandoning the nest. Sometimes we would prefer to allow the birds to hatch their own eggs, but experience has shown that small boys have a dangerous affinity for nice, oval, smashable eggs, and that fences, signs and rarity are not likely to keep boys and eggs apart for very long.

Collecting the eggs from the often well-hidden nests is ticklish business, but our aviculturists are experts and sometimes know their birds so well that ludicrous situations develop. Last April aquatic bird specialists Bardsley and Edington could be seen patiently leaning on the Marsh Garden fence every day between the 18th and the 25th of April. They had discovered that the

breeding Ashy-headed Goose usually laid between 11:30 and 12:00 noon and by the time "Mother Goose" laid her third egg, they had mastered the psychology involved so well that they were able to diffidently remove the eggs from this wild, aggressive bird's nest without even causing her to stand up.

Of course there are other reasons for collecting eggs and rearing the young artificially. Young ducklings are delicate creatures which are not likely to survive in mixed collections, where aggressive birds may attack them and where tiny natural foods are not available. Moreover, if a duck's, swan's or goose's eggs are removed from the nest as rapidly as laid, the bird may be induced to lay more eggs. Once the process of incubation on a complete clutch is well established, she is not so likely to re-lay if the eggs are removed. In some species definite and mutually exclusive hormonal coordinations may be demonstrated in the ovulating and brooding or incubating behavior. As long ago as 1887, Phillips found that by removing an egg each day from the nest of a flicker, the bird did not stop when a normal clutch had been laid, but laid a total of 71 eggs in a 73-day period. Such birds are called "indeterminate" layers, and form a sharp contrast to "determinate" layers such as the Tri-colored Blackbird or the Herring Gull, which could not be induced by John Emlen and D. E. Davis to lay more than a normal clutch of eggs. Although ornithologists tend to consider most waterfowl indeterminate layers, our experience at the Zoo indicates that the species with which we have worked are actually in a middle point of "determination." Our records indicate that abnormally large clutches may rarely be induced, but that several complete, normal clutch cycles are the more likely result of repeated egg removal. Further research is in progress on this point.

Each day in April and May brings with it the possibility of eggs from some species we have never bred before — and, incubation gets under way.

Incubation is basically just the warming of eggs, but within that concept is one of the most fascinatingly complex facets of all bird behavior. Incubation technique simply doesn't come naturally to Head Keepers and Curators; it doesn't even "come naturally" to all birds. For example,

those peculiar Australasian birds, the megapodes, don't personally incubate their eggs. Instead, the male scratches together a great mound of decaying vegetation in which the females deposit the eggs. The heat of the sun and the decomposing vegetation are partially regulated, we believe, by the male — who may manage the coverings of the eggs in response to temperature tests with his tongue. Among waterfowl, the mysterious Black-headed Duck of South America has evolved the easiest solution and lays its eggs in other birds' nests, like Europe's cuckoos and North America's cowbirds. At the Zoo the incubation of waterfowl eggs is most simply explained as a process wherein eggs are heated within a temperature range that permits their embryos to develop normally, where humidity allows proper egg respiration and evaporation and where enough egg movement is provided to prevent adhesions of the embryos' chorionic membranes. This last requirement, egg movement, is highly interesting. The incubating duck, goose or swan may be seen to stand up occasionally to poke and shove among its eggs, rolling and shifting them most typically with its lower bill, its "chin." I watched one of our Magellan Geese perform this service with its clutch three times in two hours one night last April and if she had chanced to look up from her labors that night, she would have seen a lonely figure with a flashlight moving through the strange sounds and vague movements of a great Zoo asleep, bent on a task similar to her own. She would have seen Head Keeper of Birds Joseph Bell, who leaves his Zoo apartment late each night, seven days a week over a period of nearly five months of the year, to check incubators and turn eggs. Without this drive and devotion, at every step, a breeding program could not exist. Eggs in the incubators are turned at least four times each 24 hours, and humidity is varied according to their needs. The eggs of tree-hollow nesters such as Wood Duck and Barrow's Golden-eye, for example, appear to require less moisture than others.

TEMPERATURE presents many problems, especially as it is often necessary to incubate the eggs of several species in one incubator. Temperatures higher than optimum may produce anomalies or result in the embryo's death, and temperatures lower than normal are also dangerous. It is

hard to understand how female birds regulate these delicate matters so successfully, but as Assistant Head Keeper Winnegar says, "I think they must know something." Thus far, we have found a temperature, for "forced-air" incubators, of 98° F. the most satisfactory. This will seem low to those who are familiar with waterfowl body temperatures, which may register more than 106° F. and to those who have used "still-air" incubators. The character of "forced-air" incubators holds part of the explanation. When a duck incubates, it applies its warm breast to the tops of the eggs, where the temperature may reach 100° F. or more. (Most species of waterfowl facilitate this contact by plucking down from their breasts, and this down is also used to line and insulate the nest; waterfowl develop no naked brood patches). This means, of course, that in natural incubation the egg is heated unevenly — it is warmer on top. A "still-air" incubator is usually a simple box with a heating pad fastened inside on the ceiling and it thus heats eggs "naturally," from the top. A "forced-air" incubator combines a fan with a heating element to provide perfectly even temperature throughout; the egg so incubated is warmed from all sides, and therefore the average egg temperatures rather than warm top or cold underneath should be used.

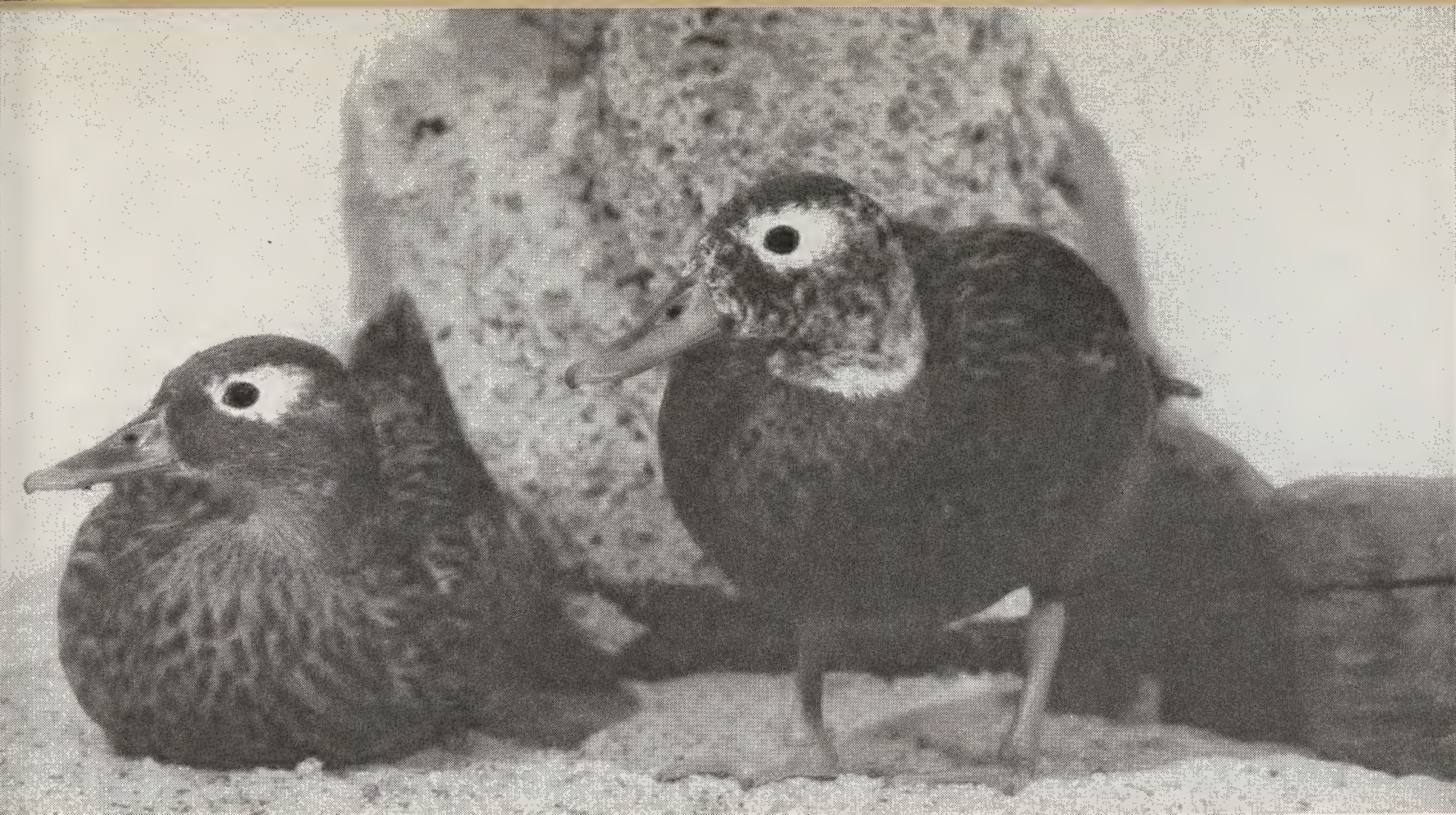
The first egg of our Laysan Teals was collected on the morning of June 1 at the Marsh Garden and deposited with the Head Keeper. Mr. Bell washed it, marked "No. 327" on the shell, and entered "327, Laysan Teal, set 6/1/60" in the "Egg Log." Thereafter it found itself proliferating warmly at 98° F., drenched and rolled over at regular intervals. By the time it had been rolled over eight or nine times in its first 48 hours, a tiny heart was beginning to beat and, revolving gently on the axis of the chalazae, the embryo rose with the turning of the nourishing yolk on the germinal disc to the ceiling of the egg. On June 4, the Curator removed No. 327 from the incubator and shone a powerful light through the shell to see if an embryo was developing. Against 327 in the Egg Log he marked "Fertile, 6/4/60." Eggs are thus "candled" regularly, checked for the development of an air cell as evaporation and respiration take place through the egg's shell, and for abnormalities. Thus we find another entry against No. 327 on June 18,

marked "development normal." And so it continued, normally and without incident, until the morning of June 28 when the duckling found itself straining to puncture the depleted calcium of its shell — and, lo and behold! — it hatched: an ugly, wet, bedraggled creature but nevertheless the most wonderfully appreciated representative its species ever had — or so the host of bird men hovering over its incubator were heard to insist.

While the hatching of each duckling varied a little, the case history of the first Laysan Teal was typical. Incubation periods vary slightly within the species and greatly from species to species. The longest in the 1960 waterfowl Egg Log was 36 days for Black-necked Swans and the shortest 26 days for several species of Teal. The longest incubation period for any bird is probably that of the Royal Albatross which incubates a patient 77½ to 80¼ days, according to Richdale. Probably no bird has an incubation period of less than 11 or 12 days. Hatching may take only an hour or two, but not infrequently a full two days is required from the first pip to final freedom.

Unlike altricial Robins, Blue Jays and Woodpeckers, which are hatched blind, naked and helpless, ducklings are "precocial." If you like tongue-twisters, you can remember, along with "Peter Piper picked a peck of pickled peppers," that ducklings are precocial, paddle-footed, ptilopaidic, partially poikilothermic young birds. This may be more understandably stated, that ducklings are hatched with their eyes wide open, able to run about soon after hatching, and to find at least part of their own food. They are covered with down but unable to maintain complete body temperature control. In the wild, within a few hours of hatching, ducklings, goslings and cygnets are led away from the nest by the female, if ducks, and by both parents, if swans or geese.

Most young waterfowl are thought to learn the appearance of their parents during a critical period not long after hatching and to learn to respond to their parents' calls, at least partially as a result of this visual "imprinting." In hole-nesting species, calls rather than visual signals are of greatest importance in imprinting and keeping the brood close to the mother. At the Zoo, young incubator-hatched waterfowl often imprint upon and follow Head Keepers Bell and Winnegar,

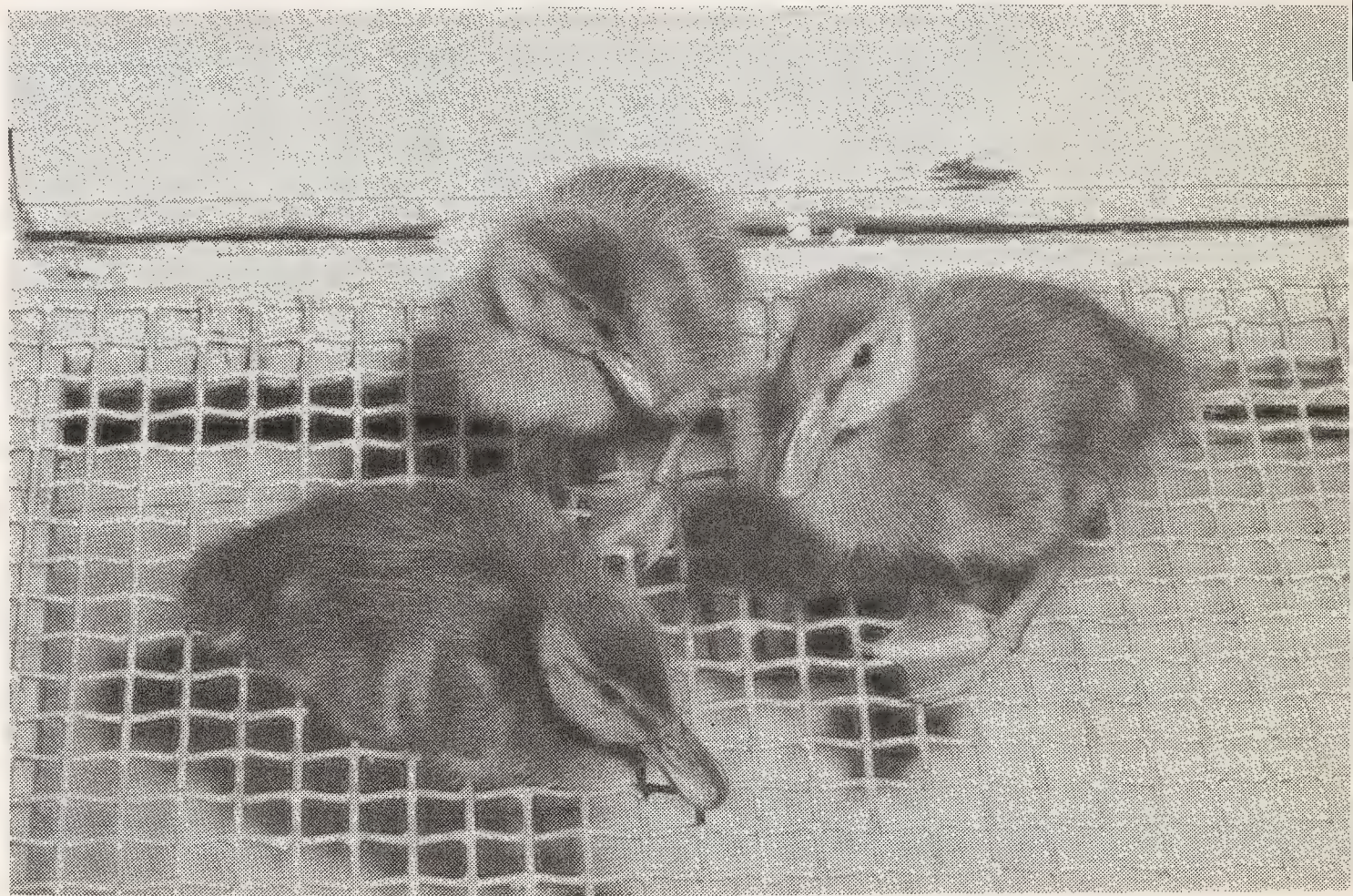


Above — Four of the rare Laysan Teal were deposited with us last spring by the Fish & Wildlife Service and the three eggs produced by one pair enabled us to hatch out (Below) these admired ducklings.

with the result that some very peculiar processions may be seen traipsing about the Head Keeper's office.

The poikilothermic nature of ducklings, that is, their inability to control their body temperatures, means that in the wild their parents must keep them warm by occasional brooding. We have developed a special brooding room with easily cleaned, specially heated enclosures called "brooders." Many of our brooders are of special design, constructed at the Zoo. Usually a small electric bulb is fastened in the ceiling of the brooder as a heat source and special water fountains and food containers are installed to cater to the young bird appetite.

Actually, teaching certain rare ducklings to eat the scientifically balanced rations we must substitute for natural food is the most critical period in the entire cycle from egg to adult. Some cygnets just do not recognize artificial rations as food. All sorts of trickery, from gentle teasing with tiny live mealworms to brute force, is employed. One of the outstanding rearing feats of the past season was performed by Assistant Head Keeper Winnegar who, through careful observation, determined that the Barrow's Golden-eye ducklings, a striking species whose eggs we had imported from Iceland, were not eating properly



and were growing weak. With continual attention over a period of four days, Andy repeatedly force-fed each fluffy, delicate duckling until it had learned to eat normally. He did not lose a single bird! Fortunately, simpler methods usually prevail. Downy youngsters may be coated with sprinkled food so that they come in contact with it while preening, or sometimes we scatter the rations on springy paper on the wire brooder floor so that the ducklings' movements cause the food to bounce and thus attract his attention. But a visitor to the Brooder Room should not be surprised to see two or three full-grown men, at any one time, leaning seriously over brooders and quacking encouragingly to their international broods.

Once normal feeding patterns are established,

ducklings grow at phenomenal rates. A Cape Teal hatched at a weight of 32 grams on July 16 had doubled his weight in six days and weighed 98 grams on July 26, and a Fulvous Tree Duck trebled his weight in 8 days. When this sort of development is in view we can sit back and sigh with relief for, barring accidents, our worries for this bird are over.

A complete list of the waterfowl hatched and reared at the Zoo in the past three years is a lengthy one, but among the highlights are Black Scoter, European Eider and Red-breasted Mergansers from eggs imported from Iceland, and Falcated Teal, Cape Teal, Chilean Widgeon, Mandarin, White-eyed Pochard, Red-crested Pochard, Rosy-billed Pochard, Ashy-headed Shelgeese, Magellan Shelgeese and European Shel-drake.

Last summer our last waterfowl egg, No. 442, a Falcated Teal, hatched on July 17. As we closed the 1960 Egg Log, word came from the United States and Canadian Wildlife Services

that wild duck populations in the great northern breeding grounds were continuing their recent steady decrease. On all sides commercial interests and expanding human populations have continued to whittle relentlessly at the last home of our former great waterfowl hosts, while unusual drought conditions have rendered much marshland a duck desert. As breeding programs produce rare waterfowl and gradually amass scientific information, new understanding of wildfowl needs is gained. This information may help, as in the case of Hawaii's Nene and Laysan Teal, to remove the danger of immediate extinction for some species. But the bright, crisp, winter day when no far-flying, whistling-winged mass of truly wild migrant waterfowl flush from our great Wildfowl Pond as the keeper comes shouting down the hill, would be a deathly quiet day, with too many echos of vanished Great Auks and Labrador Ducks.

What new species will we breed at the Zoo in 1961?

European Ferrets Are FUN 48 HOURS A DAY

By MARION McCRANE
School Lecturer, Education Department

TAKE

The body of a weasel

The face of a mink

The gentleness of an easy-going dog

The playfulness of a kitten

The fastidiousness of a cat

The suppleness of a rag doll

The flexibility of a rubberband

The mischievousness of a monkey

and

The personality of a clown

Blend these ingredients thoroughly. Yield: one

European Ferret. Ferrets as house-pets are charm-ers. They are apt to be characters — nosy, inquisitive, alert, independent, persistent, rascally, inconsistent, just downright lovable animals. Always jocose, jocular, and jocund, they are full of *joie de vivre* even as mature adults, and if there's anything in this world more fun than one ferret it's two. I know. I live with a pair. Knockwurst is an aging hob (male) and Buttonnose is a young 6-to-8-months-old jill, or female. The two of them pretty much add up to entertainment 48 hours a day.

The alert ferret dominating the picture is — of course — inquisitive little Buttonnose. Typically, the more sedate and elderly Knockwurst is curled up in the corner. He conserves his energy.



THE FERRET, *Mustela putorius*, is a first cousin to our weasels and mink and belongs to the family of musk-bearing animals, the Mustelidae, which also includes the martens, fishers, otters, skunks, badgers, and Wolverines. In the Great Plains region of the United States we have the rare and vanishing Black-footed Ferret, but this is a completely different species from the European. Ferrets are called by more names than you can shake a stick at. Besides ferret there is "polecat," "fitch," "fitchew," "fitchel," "fitchen" and "polecat ferret." In Ireland, a friend of mine informs me, ferrets trained for hunting may be "greyhounds," "line ferrets" or "bolters" — depending upon the size, color and use of the animal. Furriers know them as "Markische" and "Bavarian goldfitch." And to add to the general confusion, there is a wide variation in size and color of the ferret, according to both the geographic area and ancestry of the animal. However, the terms "polecat" and "fitch" usually designate the wild form, "ferret" the domestic. For all practical purposes they are one and the same animal, for they readily interbreed to produce even more color variations. As with many domesticated species, an albino strain has been developed, with coarse white- to dark-cream-colored-fur and the typical pink eyes, but the wild polecat or fitch as well as the domestic dark ferret is a variegated animal — brown or black legs and tail, body of white, cream or yellow underfur with black-tipped guard hairs, a masked face, pink mouth, brown oval nose and cream-rimmed ears. The average length is about 17 inches with a 6- or 7-inch tail, although males of the largest varieties may be 26 inches long and weigh as much as 8

pounds. The jills are always considerably smaller and slighter in build than the hobs.

Ferrets are little known in this country, but they have lived in close association with man for many hundreds of years. There are references to them being used for hunting by primitive tribes in Asia as far back as the first century B.C., and ferreting was a popular sport in Roman times and was described by Pliny. Ferrets trained for hunting are principally used on rats and rabbits — the purpose of the ferret being to chase the prey from its burrow and out into the open where it could be bagged, shot or killed by dogs. Working ferrets are usually muzzled when after rabbits, free when after rats; they may be on a "line" or leash, or loose and belled; they may work singly or in pairs or teams, depending on the trainer. In the line of hunting, ferrets can also be used to exterminate rats and mice from buildings.

Whereas the ferret is usually the predator, the fitch or polecat may be the prey in a moonlight hunt with a pack of hounds. Little practiced today, polecat hunting was once a popular sport in England, rather like the 'coon and 'possum hunts in some sections of the United States today. Other uses of ferrets are for dragging lines through underground pipes, and as laboratory animals — the latter especially in Europe, where they have been used in nutritional studies involving tooth development and in virus research. They by no means possess the status of the guinea pig or mouse as a lab animal, but their comparatively small size, ease of care and handling and susceptibility to virus diseases make them good test animals. The chief disease hazard of ferrets is canine distemper. All pet ferrets should be vac-

minated against this disease at the first opportunity. Ferrets are also subject to influenza, colds, pneumonia and tuberculosis. Chilling, drafts and wet or damp quarters should be guarded against. Interestingly enough, ferrets seem to be bothered more by heat than by cold, but in any event temperature extremes are to be avoided where a ferret is concerned.

The keeping of ferrets for any purpose in the United States is subject to individual state laws. Number 184 (2) of the New York State Fish and Game Laws reads as follows:

"No person shall possess, sell or breed ferrets, fitch-ferrets or fitch except under license issued by the Department, revocable at its pleasure. The fee for such license shall be five dollars. The license shall expire one year from the date of issue. No person shall dispose of a ferret, fitch-ferret or fitch except to a licensee under this subdivision, and such disposition shall be reported by the disposer within ten days thereafter."

I WAS FIRST INTRODUCED to ferrets about a year ago in the form of a small albino jill. Being the Zoo's school lecturer, I am always on the lookout for tame animals with a disposition that can stand the rigors of constant traveling and attention, and I go about the Park darkly contemplating everything from Oka the Gorilla to Sudana the Elephant as a potential pet. One day, poking around the Animal Hospital where new arrivals come for quarantining, I saw a white "weasel" rolling in the most peculiar sideways summersaults. It took about five minutes to discover what a pet she was, and I had her inside my coat and out the door almost before Dr. Gandall could give the Veterinarian's official checkout. An albino ferret resembles — with a goodly stretch of the imagination — a miniature Polar Bear, and I named my acquisition Willie, after the Zoo's big male Polar Bear. Willie was a delight from the moment she joined the Education Department. Education's animals are apt to put on more mileage and come in for more pampering than all the other animals in the Zoo put together, and Willie was no exception. She traveled to schools and hospitals and she was loved and adored right up to her sudden, untimely and heartbreaking death from lead poisoning from an unknown source. I was sick over the loss of Willie, and so

the Mammal Department compassionately ordered me another — only this time, since nothing could replace Willie — a dark one that was still a baby. After what seemed like an interminably long wait of more than a month, I found myself once again peering through the bars of a big hospital cage at another very small "weasel." But this one had lustrous dark brown fur and a masked face with an oval nose that looked like a big brown button. Albino ferrets have a reputation for being much easier to "gentle" than the dark color phase. However, Buttonnose was still enough of a baby to not really know her head from her toes, so taming took only a matter of minutes. She was probably between two and three months old at the time. Incidentally, the ferret has a well defined breeding season lasting from March until August. Two litters are usually produced, and the young are born with their eyes closed, and hairless. Their eyes open after four to five weeks, and they are weaned at about six to eight weeks.

I can always think of at least 500 reasons why *any* animal should come home with me at night, but baby animals are a cinch. From the very first day Buttonnose started to commute to work.

SOME TIME after Button's arrival I heard about Knockwurst. He had come from the Rio Grande Zoo in Albuquerque — a full-grown hob of about three or four years, supposedly very tame. Knock had been accepted by the Zoo in the event that a young jill was unavailable, and now he was on the surplus list with no room for him anywhere except that familiar cage in the Animal Hospital. Nobody wanted him. We discussed the Knockwurst situation in the Education office, sanely and sensibly. We really didn't need two ferrets. We already had our hands full caring for the animals we had. We couldn't be sure he was tame. It would be impractical and everybody agreed that we really couldn't accept him. The first chance I had, I sneaked down to the hospital. Knockwurst was enormous compared to Button, and he looked old, grizzled and just plain ratty, with no hair on his tail. His spidery whiskers curled out in front of his nose, and two imposing upper canines were prominently visible. When he saw me he paddled over to the front of the cage and sat up to be scratched under the chin, and this made the third ferret I had carried out of the hospital under my coat.

KNOCK lived in our animal room for a while and seemed happy as a mud lark, but we were careful to keep other animals well out of his reach because explicit instructions came with him to the effect that he liked people fine but with all other forms of life he was a killer. He didn't look like a killer to me, and eventually I got around to rationalizing some excuse for taking him home. Normally I spend some time introducing strange animals to each other, but in this case I had no choice. It was a Friday, I was exhausted, my arms were full of packages and a kicking, wiggling ferret, and I remember thinking out loud, "You'll just have to fight, kids, until I get my shoes off." In a second Button and Knock were together, but instead of a fight a wild, joyous wrestling-match-play began that's still going on, interrupted only by periods of sleeping and eating. Now they're both commuters.

Judging from the three I have known, I would say that a pet ferret's whole life is dedicated to play and having fun. Knockwurst is approaching middle age (life span is 9 to 10 years) and somewhat plump and lazy, but while his spurts of wild play are always surprising, they are by no means infrequent. Button, being still so young, is more like a small, brown, furry cyclone in her waking hours — bursting with energy, always going at top speed in high gear. They play a great deal with each other. Button drags Knock around by one ear, tackles him from behind and above, chews on him unmercifully, and he retaliates by obligingly rolling over or trying to knock her down by summersaulting himself against her. Some killer! Play is frequently accompanied by a "buck-buck-buck" noise that sounds like the clucking of a hen. Both animals produce it. If the game gets too rough, Button hisses with a "haa" or "ah" and a truce or time-out is called. This seems to be a warning sound, but it has never once been followed by a snarl or growl. They will also play by gently grabbing my finger in their mouth and allowing themselves to be rolled around and tickled, or in exuberant bursts of affection they will tackle my legs. They both play with balls, wastepaper baskets, string, paperbags and other household accoutrements. Knock balances a catnip ball by rolling it on his feet while lying on his side or back. For such lithe and supple animals, ferrets are extraordinarily clumsy in play.

They will roll crashing off the bed or crack their heads resoundingly against table and chair legs but never stop the game for a split second. I long ago gave up rushing to check for broken bones at the sound of a sickening thud, for by the time I reach the disaster area they are rolling around at the other end of the house. Pick a ferret up and he feels like a limp rag doll — unless he's in a hurry to get down and play.

Ferrets' tunneling instinct is easy to observe. If no rabbit burrows, rat holes, tubes or pipes are readily available in the house, they will manufacture some — out of rugs, sheets and blankets on the bed, pillows, clothes you don't immediately hang up, bath and kitchen towels. They are forever tunneling. Speaking of beds, I was surprised to learn that my two ferrets refuse to use a soft bed for the purpose for which it is intended. Few animals I have had at home could resist this luxury of captivity. Even a baby kangaroo willingly gave up the security of her ersatz pouch to curl up in bed at night, lying flat on her side. But to the ferrets it's just a big soft playground on springs. Perhaps the weather has been too warm up to now, for as intimate as they are, they have chosen quite separate sleeping quarters.

Miss McCrane seldom gets a chance to hold her pets on her lap — almost never unless they are so tired of playing they want to sleep.



Knock's "house" is under a small chest in the living room. To gain access he has to flatten out like a flying squirrel, then wiggle. Button has taken over the bureau; she prefers the third drawer up (slacks), but occasionally goes down one (pocketbooks) or up two (scarves) for a change of pace. If you want her while she's asleep, be prepared to open and close every bureau drawer. She's always in the last one. No system. But they have no objection to sleeping together if it is cool enough and they often travel to school in the same case.

Like some other mustelines I have intimately known, such as skunks, ferrets are inherently neat and clean in habit. Droppings are always in a certain corner, and like a skunk the ferret grooms its fur by scratching with the claws as well as drawing the hair through its incisors, which act like a comb. Like a skunk, too, a ferret meticulously washes his face after meals. Skunks do this by wetting the paws by licking and then rubbing down their face and whiskers. Ferrets use this and a simpler method. They just settle their chin on a rug and then run or slide — pushing the chin ahead of them to dust it off.

Their food requirements are simple enough. A good high-protein diet suitable for most carnivores is adequate for ferrets. This consists mainly of raw meat and milk, but, being fairly omnivorous, ferrets will accept a variety of foods: bread, oatmeal and other cereals, some fruit (bananas, grapes, apple), cheese, fish and eggs. Knockwurst was a picky eater at first, refusing everything except milk. But thanks to Button he is now much more of a gourmet. Milk still tops the list as his favorite food, but she has taught him to appreciate steak, cheese, roast chicken, shrimp and other culinary pleasures rightfully due a house ferret. In the beginning he wouldn't touch a piece of candy or cake, but now he can smell chocolate a mile away, and he'll almost stand on his head for the smallest blob of whipped cream. "Our Thomas' life is one of ease, involving frequent fish and cream." Substitute "Knockwurst" for "Thomas," and the old poem reads just fine. Everybody says adult ferrets should be fed twice a day (kits should get three meals) in the amount that they will consume completely in a few minutes. This is impossible. At least in a house it's impossible. Ferrets don't eat their food — they

cache it! Caching is a well known behavioral trait of many wild animals — hamsters, foxes, some of the big cats and other mustelines are noted for their food-hiding tendencies — but it's ferrets that get my vote for masters of the art. They can and will hide anything except absolute liquids. The spots they find to tuck away morsels in a small three-room apartment are fantastic. I can't vouch for a ferret's intelligence, but I can tell you that *I'm* always at least ten steps behind in this battle of the food pile. Ever put a foot in your loafer and find the toe stuffed with soft-boiled egg? I have extracted pieces of steak from the middle of a stack of clean, pressed pajamas, globs of horsemeat from under the livingroom rug, found a slipper under the bed packed with goodies, and peered hopelessly through the grill of a radiator at a totally inaccessible pile of tidbits. They are so sneaky and surreptitious about it. The only solution is to hand-feed them every bite, or lock them in the bath for meals. This may be time-consuming and inconvenient, but it's worth it if you don't particularly relish having your toes coated with cold, sticky egg.

I am convinced ferrets get into trouble for the sheer joy of making a mess. If they can bolt into a cupboard, pots, pans, dishes and supplies go flying. Extricate the troublemaker and he runs good-naturedly off to look for some other mischief. Books come out of the lower shelves of bookcases like a slow round of machine gun bullets. They kick them with their feet.

The slowest typical gait of a ferret is a walk with little mincing steps and high-arched back. More often than not they bounce along in this position and will leap several inches in the air from a dead stand-still when they're feeling good. Their nature is completely antipodean in so many respects, and this is a big part of their charm. One minute they are streaking along the floor, flat and silent, "weasel fashion," the next galloping clumsily across the kitchen linoleum, making more noise by stamping their feet than a herd of elephants. Young ferrets at least are good climbers and jumpers. There is no chair or table in the house inaccessible to Button when she feels determined, and she never hesitates to climb straight up clothes to reach your shoulder — to the despair of the silk stocking supply. Shoulders make the best vantage points for leaps. Knockwurst,

though, spends his time on the ground. I have to lift him up on the couch, and the most he'll do is sit up to inspect the top of the coffee table for something to eat. I have a feeling he's just too fat and lazy to climb. And the happy day may come, in a year or so, when it will no longer be necessary to rescue Button from the tops of screens and wildly swinging draperies.

During the hottest days of the summer I tried soaking Button to keep her cool, and she took to water like an otter. From a dish she graduated to the bathtub. She's a superb swimmer. She can submerge, come up, and with one shake be perfectly dry — unless she plays for hours in the water, which she is wont to do. Then she gets soaked and it takes a vigorous rub-down to dry her off, but this is almost as much fun as playing in the water and spurs her to unexcelled heights of frantic play and "buck-bucking." She is strongly attracted to all liquids. It is nothing for her to dive unconcernedly and unthinkingly into a martini, glass of grape juice, or a bucket of hot, soapy water. A defrosting refrigerator is just her meat. All that icy water to slosh around in! Knockwurst, on the other hand, has a spasm if even so much as one whisker gets wet with anything other than milk. I thought Button would teach him to play in water. She tried, but it didn't work. He swam for his life — panic-stricken — in a perfectly dry tub, so we didn't press the issue.

The equanimity of ferrets is marvelous. Absolutely nothing bothers them. A noisy vacuum cleaner met for the first time is just a big, new, shiny toy — something to pounce on and tackle. They will roll out of their carrying cases onto a strange school stage and play with the same care-free life-is-just-a-bowl-of-cherries unconcernedness as if they were in the middle of their own living-room floor. They are extroverts. They like people — even strangers — and a tame ferret can be handled with impunity by anyone. Ferrets are about the most trustworthy animals I have ever used for lectures, and this gentleness of disposition makes them perfect for use with sick and handicapped children. Few adults can resist them either. I have the vivid impression of Knockwurst, one day while he was in the office, being surrounded by a bevy of pretty secretaries all cooing over him. He was lying on his back on some-

one's lap being fed an assortment of cookies — soaking up the attention. And again an antithesis in ferret character. Despite their instinctive hunting prowess, ferrets do get along with other animals. Button got off to a good start, for she was raised with a baby skunk named Hunky Davis, but even Knockwurst tolerates other creatures. Ferrets are curious about newcomers (they're curious about everything). Mine got their feet stuck on a hedgehog who lived in the livingroom closet for a weekend. And sometimes ferret rough-and-tumble play is too exuberant, but it is anything but attack. This fall there is a new and terribly shy young Fennec Fox at home with us, and just a while ago I heard her squeals of protest from under the bed. When I went to investigate, Knock was gently prodding her with his head to move over so that he, too, could curl up in her warm blankets. A killer indeed!

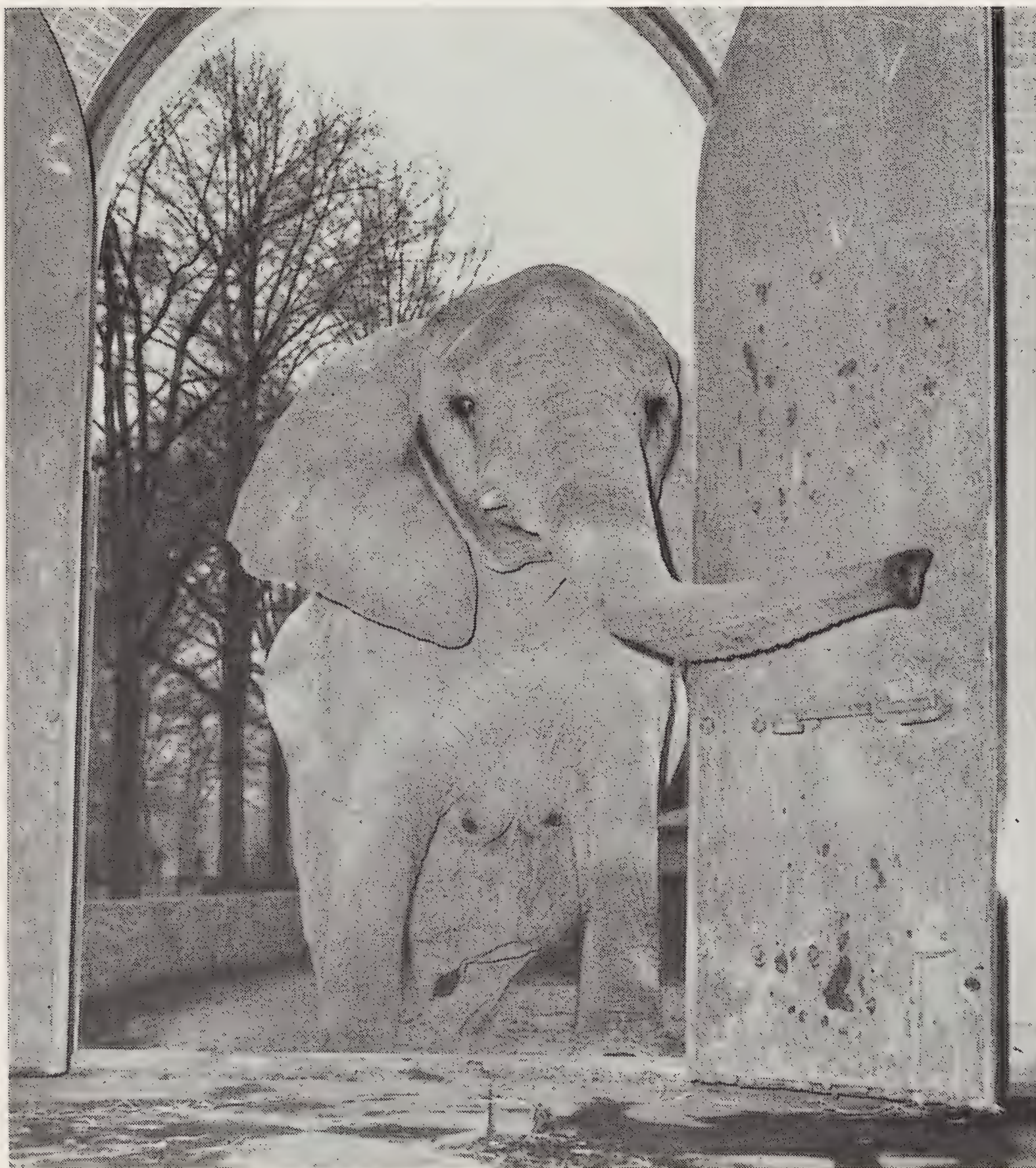
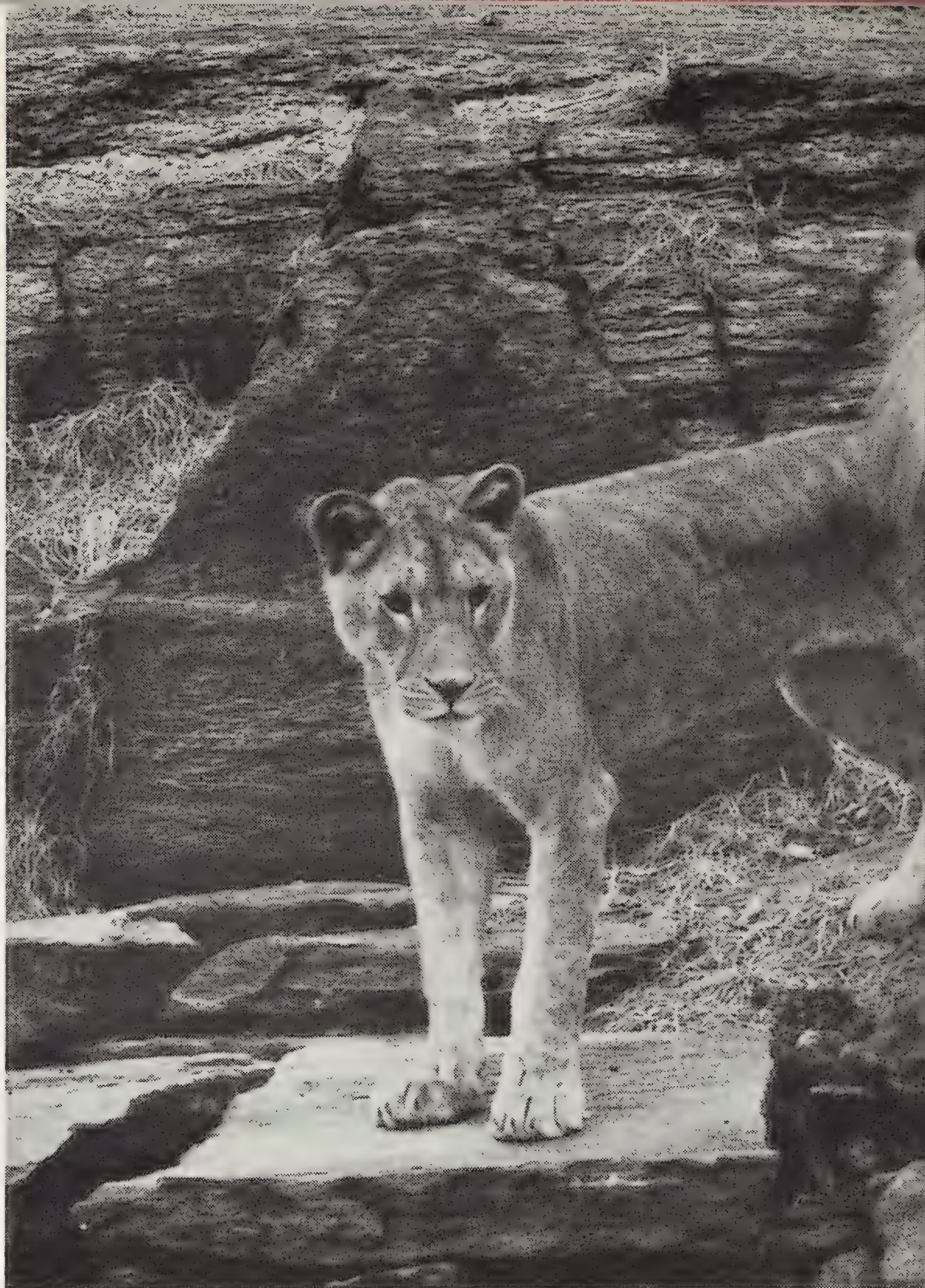
The books say that ferrets are not affectionate, and it is perfectly true that they don't fawn over their owner. But they shouldn't be expected to. They're not dogs, they're ferrets, and in some respects quite independent. They will come when they are called — if they feel like it. But they do show some affection in their own way. I always get a greeting from Button when I come home at night, in the form of a brief stay in my lap and a lick or two, and old Knockwurst will from time to time lie with his chin on my foot. This happened once while I was doing dishes and though he winced at every drop of water splashed on him, he never moved.

Ferrets are very unpredictable animals. On mornings when you've slightly overslept, they've been up since the crack of dawn making a mess. They are constantly under foot as you try to hurry, demand two dishes of oatmeal each, tackle from opposite directions as you hop around trying to dress, and create general bedlam until you manage to get out the door. The next day you rise early purposely to have time to cope with two active ferrets, and they sleep angelically and even have to be roused for breakfast. This may be a hindrance to navigation and a detriment to progress, but it is impossible to get mad at a ferret. They are devilish and time-consuming. If you're not straightening up after them you're spending hours just watching their antics. But they're worth every minute of it.

ZOO NEWS IN PICTURES

Photographs By SAM DUNTON

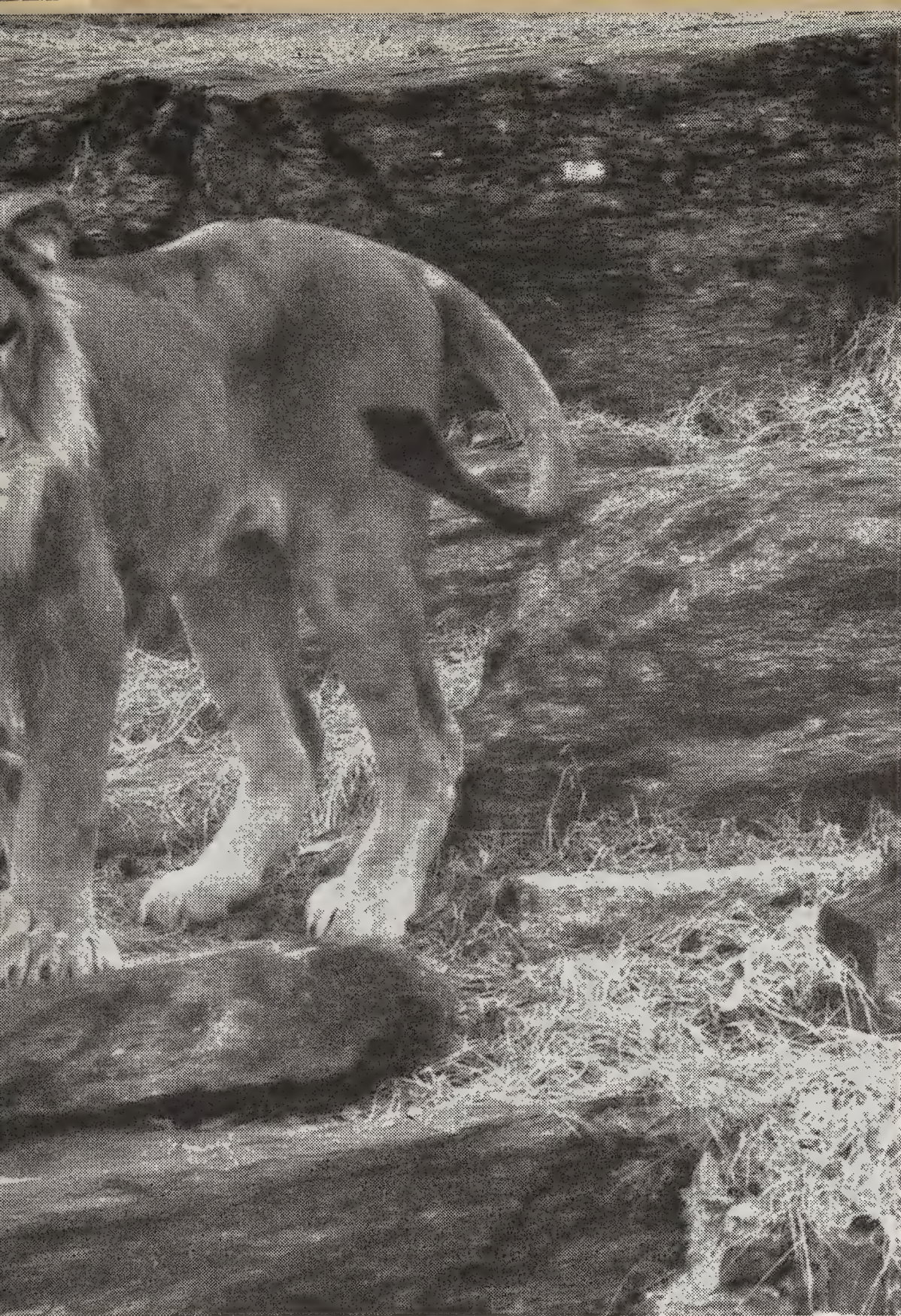
Eager to reach her supper, "Sudana," the **AFRICAN ELEPHANT**, charges into her stall in the Elephant House on a late November afternoon. Ordinarily the Elephants are locked in by this time of the year, but unusually mild weather has enabled us to keep them outside until quite late in the season.



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This **LLAMA** named "Joy" and the yo
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For the rest of the winter they will sh





is no novelty on the plains of Africa, but a decided innovation in the Zoo. Ever since its opening in 1941, our exhibit has featured 4 to 6 young male Lions. Recently we have been working toward the creation of a Lion family, and a young pair in luck, we may have a show of Lion cubs in a year or two.

AN DEER named "Asahi" was killed last summer, and on closing day was being skinned. Given their close relationship, they stayed close together. On the west side of the Zoo.



All of the foliage in these two photographs of compartments in the Bird House is artificial — and in the lower one, the home of our Indian Paradise Flycatchers, even the rockwork is made of styrofoam carved and painted to look like rock. The great advantage of artificial foliage is that the birds do not destroy it and it can be easily and quickly cleaned. One leaf on the floor of the bottom picture has been shaped as a watering tray.



Thermistors,

DOES THE TITLE of this article seem to bear little relation to either herpetology or reptile-keeping? Yet, when I think about the outstanding happenings of 1960 in the Bronx Zoo's Reptile Department, these are the things that come to mind. Some people might assume that they are an inevitable sign of the times — these times when everything is becoming mechanized, elaborated and "scientific." However, to me "Thermistors, Air Conditioners and Insecticides" are a great deal more significant and exciting than that.

You do not have to look very far back to discover a time when the number of animals purchased for a Zoo's Reptile House each year far exceeded the number of reptiles exhibited in that same time. While this situation is in the dim past for most of the major zoological parks, it still holds true for many of the small collections in this country — and for many of the zoological gardens of the Old World, too.

Zoological parks tend to evolve and as they become more professional institutions, specialists are engaged to look after various segments of the collection. There is a similar evolution in animal care: more and more is being learned about the basic living requirements of the different animals. Nowhere has this shift from the old-fashioned "menagerie" to the modern zoological collection been more dramatic than in the reptile departments. Animal purchases actually become a minor part of the budget and longevity records of 5, 10 and even 25 years become commonplace. Breeding activities among the animals have now become something to prepare for, rather than an unusual or unique occurrence.

This is not to say that many problems in reptile-keeping do not remain. There are still numerous species whose basic requirements are so little known that no zoological park has yet been able to maintain them, while others have such unusual requirements that, although they are recognized, no one yet has the proper facilities to ac-

Air Conditioners

commodate them. Even for common species there are many basic questions still unanswered. What are the proper temperatures for reptile hibernation? Do some reptiles need a seasonal variation in temperature? Or a daily variation? Do some need sunlight (or ultraviolet rays) to grow properly? Many such questions occupy the thinking-time of Curators of Reptiles.

Here is where thermistors, air-conditioners and new insecticides come in, for they have been responsible for some major contributions to the knowledge of reptiles (and thus to their proper care) during 1960. More detailed reports on some of these matters will appear elsewhere, but the preliminary observations are striking enough to justify summarizing here.

A "THERMISTOR" is merely an electric thermometer — a small device that registers degrees on a dial when a minute electric current flows between two slivers of metal that respond unequally to changes in temperature. Developed and refined in the past few years, they have made it possible to obtain the body temperature of animals with considerable accuracy — and with a minimum of disturbance to the animal. The use of one of these devices in the Reptile House this year has allowed a detailed study of the temperature relations of two brooding pythons. We hope that this study will settle — once and for all — the ancient question of whether "pythons" (please note the general term) *incubate* their eggs or merely *guard* them during the weeks that they lie coiled about their clutches.

This question has been argued for well over 100 years. The debate began in 1832 when M. Lamarre-Piquot of Paris reported to the French Academy that he had measured the temperature of a brooding Bengal Python at the Zoological

Gardens and found it to be considerably higher than the temperature of the enclosure.

M. Lamarre-Piquot's findings were attacked violently by the celebrated M. Duméril, a leading herpetologist of the Paris Museum, who pointed out that M. Lamarre-Piquot was not much of a herpetologist (which was true) and that he had likely been measuring heat from the warm water under the cage (which was not true). A second, and independent, study was made and it sup-

& Insecticides

ported the findings of M. Lamarre-Piquot, but again M. Duméril insisted that everyone knew that reptiles were cold blooded, so there must be some mistake in the observations. The argument continued in Paris for 26 years and by the time it died of inanition no one was sure whether a python could incubate its eggs or not.

Still, it was an interesting point, and others took it up. Since that time, studies have been made in London, Frankfurt, Basel, Washington and New York. Typically, some of the investigators reported that the female python did raise its temperature above that of the surroundings while others could find no such rise. It has remained an open question — for the dogmatism of a Duméril has gone out of fashion among modern scientists.

One of the basic problems has been that it is difficult to obtain the "environmental temperature" and thus to determine the source of any heat. This problem has been much reduced by the new thermistors. Still another complication has been that almost every worker has investigated a different species of python and then compared his findings with the others, on the assumption that all pythons must be alike in their habits.

A few months ago in the New York Zoological Park we had a unique opportunity to study the breeding habits of two species of pythons at the same time. An Indian Rock Python (*Python*

Thermistors, which are merely electrically operated thermometers, have been inserted among the coils of the incubating Indian Python. She raised her temperature about 10° on the nest.

molurus) laid a clutch of eggs in her exhibit cage on April 6. Five days later, on April 11, an African Rock Python (*Python sebae*) laid a clutch in another enclosure. Each female snake coiled around her eggs in typical python fashion. Here we had the basic materials for really comparative observations.

Soon after the eggs were laid, probes from the thermistor-thermometer were positioned so as to give information on every possible source of

By HERNDON G. DOWLING

Curator of Reptiles

heat, natural or adventitious. Daily records, and one 24-hour hourly record, were obtained from each of the probes.

The findings were surprising. The African Python's body transmitted a temperature generally between that of the floor and that of the air — thus, not suggesting any internal heat production. The Indian Python, on the other hand, maintained a relatively constant temperature of about 90° F. (plus or minus 3 degrees) — and this in spite of variations in environmental temperatures that amounted to as much as 12 degrees. She commonly held a temperature of 90° while



the environmental temperature was 80° or less. Furthermore, it could be determined that she raised her temperature through violent muscular contractions (visible enough to be reported in the newspapers as "hiccups"). The lower the environmental temperature, the more rapidly came the contractions, sometimes amounting to as many as 38 per minute.

Unfortunately, the eggs of the Indian Python were attacked by a fungus infection that killed all of the developing embryos. While this loss did not affect the results of the temperature observations, it was keenly felt by all members of the Reptile Department. In contrast, 41 healthy African Pythons were hatched. Various members of this brood may be seen now, not only in our

Zoological Park but in other major zoos from San Diego to Zurich.

Previous investigators had not been able to measure the environmental temperatures accurately, nor had they been able to obtain the temperature of the snake without disturbing it. But the new instrument, the thermistor-thermometer, was ignored by the snakes and thus has allowed us to be the first to observe the relationship of muscular contractions to the demonstrated production of heat in the Indian Python brooding female, and to further demonstrate her ability in adjusting the heat production so as to maintain a constant temperature for the developing eggs. M. Lamarre-Piquot would be gratified, for his "Bengal Python" was what we now call the Indian Python.

Dr. Dowling takes a close look at some of the 41 African Rock Pythons hatched this year. No rise in temperature could be detected by thermistors testing the brooding African's coils.

ONE OF THE wall sections of the Reptile House exhibit area was closed in and air-conditioned for the first time in 1960. The only previous "cool room" area had been the small re-



frigerated section containing the Tuatara and various salamanders. This new section contains about 20 snake cases and thus gives us the first opportunity of exhibiting snakes from the North Temperate regions of America, Europe and Asia under proper conditions.

My trip to Trinidad last spring had allowed me to investigate the temperature relations of some of the lesser-known tropical reptiles, and I came back with the conclusion that while it is certainly true that many tropical reptiles are active in the daytime and require the typical "reptile house" temperatures of 80° to 90°, this is not true of all of them.

My study in Trinidad had been concentrated on the natural environment of the Bushmaster (*Lachesis muta*), which has been reported in some detail previously (*Animal Kingdom*, May-June, 1960). It had shown that this nocturnal inhabitant of mountain forests probably never met temperatures as high as 70°, and that the normal Reptile House temperatures were literally "burning up" the specimens we had previously exhibited. Consequently, when I brought back a young individual, and when the members of the Tropical Research Station later sent up another one, they were placed in the air-conditioned section where Trinidad forest coolness could be approximated.

For seven months things went on beautifully. One Bushmaster fed six times, the other four times, and both shed their skins twice in normal fashion. Then we learned that air-conditioning does not solve all Bushmaster problems. The snake that had fed six times suddenly sickened and died, and we discovered that in our care to preserve the low temperatures, high humidity and low light level that seemed necessary, we unwittingly allowed a fungus infection to penetrate the belly scales of our most promising specimen. Still, the other Bushmaster (seven months, four feedings) is still doing well, and this time we are watching out for fungus. In any event, no other zoological park has succeeded in keeping Bushmasters this long.

Thus, it appears that the time has already arrived when an air-conditioned section has become one of the major aids to reptile-keeping. Not only temperate reptiles and Bushmasters may be helped thereby, but the keeping of many of the

nocturnal rainforest and tropical mountain "hard-to-keep" species may have entered a new era.

MOST PEOPLE — and this includes even reptile enthusiasts — have never heard of the common snake-mite (*Ophionyssus natricis*). Yet this tiny arachnid, whose adult size is smaller than the head of a pin, has always been the scourge of the major reptile collections. These blood-sucking mites flourish under the conditions of high heat and high humidity prevalent in Reptile Houses. Individually they are too small to be a real danger to the health of a reptile, but they multiply into astronomical numbers within days and a snake that appears mite-free one week may be drained of its life's blood the next.

Fighting mites in a large Reptile House is like fighting a brush fire on a windy day. Just when you think you have them licked in one range of cages, they blossom in another. This running battle has been going on for generations of reptile-keepers, and only last year I estimated that mites, alone, cost our Reptile Department at least \$2,000 a year in lost specimens and in keeper time spent in attempts at control. Australian reptiles appear to be particularly susceptible to mite infestations, and a few years ago when a thriving group of the rare Taipans suddenly went off their feed, sickened and died, the postmortem verdict was, of course, mites.

For incoming reptiles, a strict routine of overnight soaking, visual inspection and extended quarantine was established in our Reptile House many years ago. It helped, but still the mites passed through; obviously some new and radical approach would have to be made if we were ever to rid ourselves of this plague. Expert help was needed and last year the Zoological Society made a grant of \$4,375 for the study of new insecticides applicable to mite control.

We knew the solution would not be easy, for most insecticides sufficiently potent to kill mites are more than potent enough to kill reptiles. DDT is an example; when it was first introduced as an insecticide in the 'forties, reptile keepers enthusiastically dusted, sprinkled and sprayed their charges — only to discover that it was the snakes, not the mites, that died. Various less potent insecticides were tried, too. Some of them did not kill the reptiles, but they did not kill the mites, either.



Realizing that we did not have the personnel or the equipment to undertake an exhaustive insecticide study, the Society engaged the Midwest Research Institute of Kansas City to tackle the problem. Under the leadership of Mr. Gary Clarke, scientists at the Institute and such consulting specialists as Dr. Joseph H. Camin of the University of Kansas, an authority on snake mites, tested an impressive series of promising chemicals, first on the mite and then on reptiles.

While this study was going on, Dr. I. Barry Tarshis of the University of California Agriculture Research Station in Los Angeles reported on a study he had made on snake mites. Under the conditions of his tests, a new compound called Dri-Die 67 (supplied by the Davison Manufacturing Company of Baltimore) killed 100 per cent. of the mites in a snake cage without injuring the reptiles. He noted that this compound was chemically inert and that it retained its effectiveness for more than a year.

Above — Headkeeper Spencook makes periodic inspections of the snakes for signs of mites. Right — Not as large as the head of a pin, but deadly when its numbers increase enormously: the snake-mite.

Photomicrograph by Ross F. Nigrelli

To a mite-plagued Curator of Reptiles, this sounded like the millenium! A quantity of Dri-Die was ordered immediately. It proved to be a very light, finely-ground powder that adhered closely to almost any surface. On the tiny mites it acted as an abrasive and scraped away the waxy coating that made their bodies water-tight. With the waxy coating removed, the mite simply dried up. Since no toxic substances were involved, there was no danger that the insecticide would be toxic to the reptiles. Obviously, this was a promising new approach. The Midwest Research Institute had already made some preliminary tests of Dri-Die, and now it began a more intensive investigation.

Impressed by the reports and too beset by mites

to wait for the final results, we began using Dri-Die in the Reptile House in an experimental fashion. At first we noticed what Dr. Tarshis's experiments had shown — apparent 100 per cent. mite kill and no injury to the reptiles. About this time, however, our usual summer spell of hot and muggy weather came along and mites began to reappear in some of the previously dusted cages. But Dri-Die was supposed to last for at least a year! What was the trouble? Our reports from Midwest were not too encouraging, either. In some of their tests, the mites lived longer than they should have — if the miticide was to be considered fully effective.

The reason for these diverse results soon became plain. In California, where Dr. Tarshis had done his experiments, the humidity was consistently low, so that as soon as a mite lost its waxy covering, it dried up. But in the Bronx Zoo's Reptile House the summertime humidity is something more than 90 per cent. and under those conditions a mite that had some of its wax scrubbed off still kept moist. The humidity was too high to allow it to dry up.

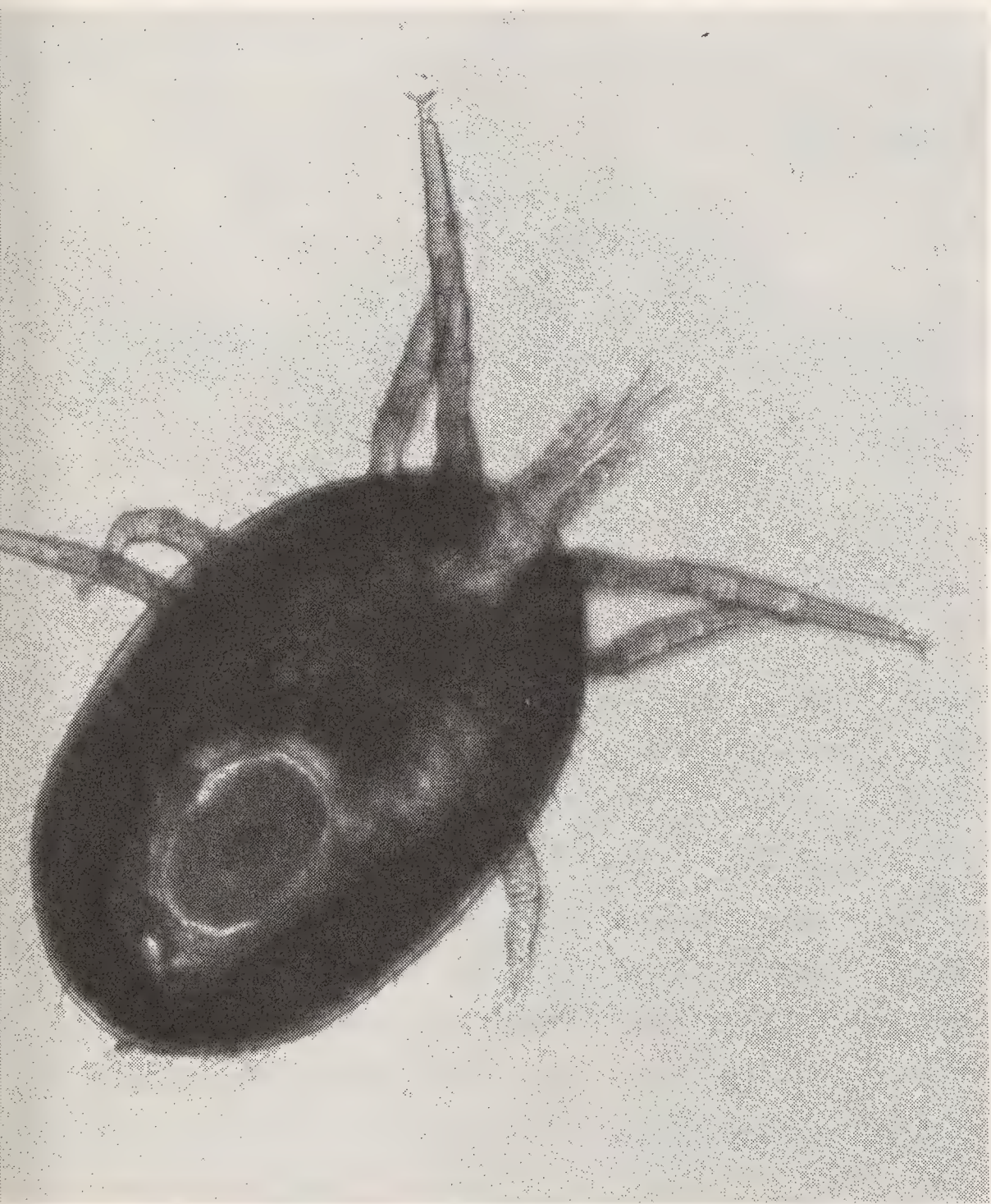
So it turned out that Dri-Die was not the cure-all for mites that we had hoped for. Nevertheless,

it is far superior to anything else that we have tried. Now that our less humid Fall has come around, we are again experiencing full success in mite eradication. We also have learned to be a little more careful in the use of Dri-Die. If it does not seem effective in a cage, we examine the area thoroughly to see why. More often than not we find a damp spot under the gravel somewhere — where the mites can offset their moisture loss. We have also become suspicious that perhaps the Dri-Die adversely affects the skin of a snake (particularly a smooth-scaled snake) that is about to moult. So now we are careful not to dust a cage that has a snake in that condition.

After so many years of hopeless battle, should we complain too bitterly if we have to wait until winter to kill our mites? Who knows? If we are careful about snakes about to shed their skins, check the cages carefully for damp spots, and dust the Dri-Die when the humidity is low, we may clear the Reptile House of mites this winter. If we do, it will be the first time that building has been mite-free since it opened in 1899.

A new era in reptile-keeping has certainly dawned. As if to emphasize this point, I have just received a "preliminary final" report from the Midwest Research Institute. It says that two other insecticides have shown themselves in comprehensive tests to be superior to Dri-Die in mite-killing ability — and are equally non-toxic to reptiles. These are *Diazinon 25-E* (Conservation Industries) and *Ortho-Dibron 8-E* (California Spray Corporation). What more can we ask?

REPTILE-KEEPING, like all zoo work, is a team operation. In addition to our competent Head Keeper, Stephen Spencook, who supervises the daily care of the 700 or more inhabitants of the Reptile House, we are privileged to have devoted keepers such as Peter Brazaitis who kept an especially sharp eye on his charges' welfare during the testing of the Dri-Die and Robert Brandner whose special concern has been the health of the Bushmasters. Willard Mlott (as a volunteer) sat up all night with the brooding pythons and thus obtained the 24-hour record of their temperatures. For all of these men the welfare of the animals has been a major concern, and they have carried this concern far beyond what would be expected of them "in line of duty."





Under conditions of seclusion in the basement of the Lion House, our Mountain Beavers seem perfectly contented. Problems will arise when we exhibit them in the Small Mammal House.

Haymakers from the Northwest —

TWO MOUNTAIN BEAVERS

By WILLIAM BRIDGES

Curator of Publications

UNTIL A FEW WEEKS AGO, Mountain Beavers had not been seen in the Bronx Zoo since 1905 — which is about par for the course. People who live in the heart of Mountain Beaver country in the Pacific Northwest seldom see them, either. But *if* our present pair continue to thrive as they seem to be doing, and *if* our Mammal Department succeeds in inventing an air-conditioned and glass-sided burrow, it may well be that more people will see Mountain Beav-

ers in New York than ever glimpsed them in the mountain forests from British Columbia south to northern California.

They are not Beavers, incidentally — merely short-haired, grizzled chestnut, burrowing rodents about 14 inches long including the tail, which is so short it can hardly be measured. Sometimes they are referred to as Sewellels, instead of Mountain Beavers, but the latter name has been used so long in the West that we shall call them

that when they go on exhibition in the Small Mammal House later this winter. There are plenty of other names to choose from, too: Mountain Boomer, Showt'l, Squallah, Giant Mole, O-gwool-lal and Kick-willy. It is tempting to use Kick-willy, but Mountain Beaver and Sewellel are really more widely used, so we shall have to forego it. The scientific name is *Aplodontia rufa pacifica*, and ours is one of the more nearly coastal of the nine subspecies.

The alternative name Sewellel is just about as much a misnomer as Mountain Beaver. The actual Chinook name for the animal is O-gwool-lal, but Sewellel was pinned on it because of a misunderstanding by Clark (of the Lewis and Clark Expedition). On Friday, December 13, 1805, Clark was at what is now Astoria, Wash., and he and Lewis bought various skins from the Chinooks. Apparently they were having mutual language difficulties, for when Clark asked the name of the animal he was told "She-wal-lal" — a phrase that means "for making a robe." Clark took it to be the Indian name of the animal, and wrote it down phonetically as "Sewellel," and thus confusion was complete. So Sewellel it is today, as runner up to Mountain Beaver as a popular name.

Fortunately, a number of naturalists have been interested in the Mountain Beaver since Clark "discovered" it, and a fair amount is known about its habits — enough to make us realize that it is going to take a good deal of ingenuity to exhibit it satisfactorily. It is a confirmed and industrious burrower, and by strong preference a nightloving animal, so that Curator Davis's problem is to convert it to daytime activity if he can, and at the very least to make it visible in daytime asleep within its tunnels.

The kind of burrows the Mountain Beaver likes do not make the problem any simpler, for it is usually found in deep alluvial soil so damp that it literally oozes water. Indeed, when its system of tunnels is on a slope, water sometimes runs out of the lower openings. John Muir once wrote about how startling it was "when one is camped on the edge of a sloping meadow near the homes of these industrious mountaineers, to be awakened in the still night by the sound of water rushing and gurgling under one's head in a newly formed canal."

An absolutely wet earthen burrow, glass-sided for exhibition visibility, is impractical under Zoo conditions, but it does not seem to be necessary, for our two animals appear to be quite happy in their temporary quarters in the basement of the Lion House, and there their earth is only slightly damp. They are quartered for the present in the long and deep concrete boxes built more than ten years ago as an "earthworm farm" to supply our voracious Duck-billed Platypuses. Both animals started burrows almost immediately after they were introduced to their temporary home, but scarcely went below the surface. They have to be kept separate, for they are known to fight viciously.

Ernest Thompson Seton calls the Mountain Beaver "slightly gregarious" in its habits, as distinguished from "social," and the behavior of our pair seems to be in accord with this distinction; our male and female are certainly not social at the moment.

As for their gregariousness in nature, they seem to live in colonies inhabiting a complex network of burrows 6 to 8 inches in diameter. It may be that only one family inhabits this network and has comparatively little contact with other Mountain Beavers in the immediate neighborhood. The burrows run through areas of good food — Seton remarks that this includes "really every green, succulent, and semi-succulent plant, shrub and bark that is found in the rich, wet grounds" — and seem to be as much for the protection of the animal as anything else, for when a tunnel runs under a log, it is likely to be a mere surface trail under the log and goes underground only at the end.

One of the interesting habits of the animal is that of "haymaking." A good many naturalists have observed this. The Mountain Beaver appears to cut green plants and then lay them up to dry, sometimes over one of the many entrances to its burrows. When they are withered they are dragged inside. It is a little uncertain whether the "hay" is used for bedding, or for food — but maybe it is both. It is possible that the withered stems and leaves are used as bedding for a while, and then eaten. It would certainly be convenient.

Our Mountain Beavers have had no chance to make hay, for they are given such provender as sweet potatoes, apples, carrots and lettuce. A

quantity of bamboo leaves was supplied, and these they immediately appropriated for what seem to be open-roof nests.

Our animals came from Dr. Murray Johnson of the University of Puget Sound, who had used them in his investigations of the phylogenetic re-

lationships of North American mammals through comparison of their blood proteins. We know so much more about their lives and requirements now than we did in 1905 that we *think* we have a good chance to make them happy in the Small Mammal House.

News from the Conservation Foundation

Follow-up on Pesticides Conference

A conference on "Implications of Increasing Use of Chemical Pesticides," made possible by a grant from the Rockefeller Foundation, was sponsored by the Conservation Foundation in November of last year. Speculation as to the value of conferences, generally and this one in particular prompted Dr. Osborn to draft a letter asking for the reactions of its 22 participants. W. H. Larimer, Executive Secretary of the Committee on Pest Control and Wildlife Relationships of the National Academy of Sciences, replied that "... this particular conference was unusually valuable to me in establishing new associations. . . ." A. W. A. Brown, head of the Department of Zoology of the University of Western Ontario, wrote that "the value of the conference . . . is that it enables me to carry back to my country the most up-to-date thinking on the problems of pesticides and wildlife." Dr. W. R. Henson of the Yale School of Forestry noted: "... I find many changes in my position. I'm sure a number of these changes grew from things I learned during the 1959 meeting."

Daniel L. Leedy, Chief of the Branch of Wildlife Research of the Fish and Wildlife Service, emphasized that "... it provided an opportunity to meet a dozen or more people concerned in one way or another with pesticide use whom I had never met previously, and to become better acquainted with others." E. F. Knipling, Director of the Entomology Research Division of the Department of Agriculture, found that "the Conference . . . made me realize more fully the total implications of pesticide use on organisms in an environment and consequently the importance of

studies to obtain more basic facts so that the advantages and disadvantages of pesticide uses can be properly weighed."

Conservation Aptitude Tests

More than sixty school systems have offered to use the Foundation's "Test of Reasoning in Conservation," according to Dr. Paul F. Brandwein, Director of Education. This 40-minute test for high school students was devised by the Educational Testing Service of Princeton, New Jersey, in collaboration with our Education staff, and has recently been thoroughly tried out in the Oregon public school system. The test seeks to determine not only the resource knowledge of the student, but the validity of the method of teaching conservation. A statistical analysis of the Oregon results indicates that they are best adapted to the senior high school year and to college freshmen, less successful when administered to the middle grades. The analysis also revealed that small rural schools do less well than the urban communities.

Dr. Brandwein states that further analysis of the Oregon experiment, sorting the dull students from the bright as a measure of the validity of the individual questions, will determine a final form of test which can be generally published. It is believed that these tests will increase the breadth of conservation teaching in the school system of the nation.

Briefly Noted

The November issue of *Scientific American* contains an article by Frank Darling on "Wildlife Husbandry in Africa." . . . Roger Hale at-

tended the American Forestry Association meeting held October 16-19 in Edgewater, Mississippi, and the meeting of the Society of American Foresters in Washington, D. C., November 14-16. He represented the Foundation again at the Executive Committee meeting of the Natural Resources Council, Washington, November 17, and on November 21-22 at the Northeastern Loggers Association Conference in Harrisburg, Pennsylvania, where he presided over a session on "Planning New or Expanded Forest Industries." . . . The Fifth Annual Eastern Central States Conservation Education Conference, held November 4-6 at Michigan State University's Gull Lake Biological Station, included a panel discussion on "Testing Evaluation of Conservation Instruction"

in which Martha Munzer, Foundation Project Assistant in Education, was a participant . . . Belmont Pitkin of our Research Department, substituting for Wallace Bowman, attended a Projects Committee meeting of Nature Centers for Young America in New York on October 13 . . . Noted visitors to the Foundation offices this fall have included Max Nicholson, Director-General of Britain's Nature Conservancy; President William R. Wood of the University of Alaska; Dr. Enrique Beltran, Director of the Natural Renewable Resources Institute of Mexico City; and Dr. Edward M. Graham, Director of the Plant Technology Division of the U. S. Soil Conservation Service.

BEHIND THE SCENES

NEWS AND NOTES OF THE ZOOLOGICAL PARK, THE AQUARIUM AND THE DEPARTMENT OF TROPICAL RESEARCH

The Staff Travels—on a Variety of Special Projects

The discovery of an African tick, *Rhipicephalus evertsi*, on an Eland in the "Africa USA" exhibit in Florida this fall has caused a flurry of concern among Zoo and Federal veterinarians, for the tick is known to carry "East Coast fever." As part of the routine of examining other possible carriers of the ticks, a team of Federal veterinarians made minute inspections of 27 of our animals, of 20 species, but found nothing. Subsequently Dr. Charles P. Gandall attended a meeting in Chicago called by Dr. L. C. Heemstra, Director of the Animal Import and Quarantine Division of the Department of Agriculture, at which a tentative program of inspection of all ruminants and hoofed animals, by accredited veterinarians, on arrival at a zoo, was decided upon. The tick is of a type most commonly found on equines, and the lack of brush in most Zoo enclosures does not favor its persistence or spread in this country.

Liver tumors in our western Rainbow Trout are still under investigation and in November Dr. Ross F. Nigrelli, the Aquarium's Pathologist, attended a special meeting on the subject in

Washington. The Public Health Service wanted to know whether the disease could affect man (there is no indication that it can), the National Cancer Institute is interested in the cancer-like characteristics of the disease, and the Fish and Wildlife Service is concerned to halt the disease before it spreads. Dr. Nigrelli, who has done much pioneering work on tumors in fishes, believes that by no means all of the reported growths are cancerous. Studies of the effects of inheritance and diet on production of the tumors are now being made.

Associate Director Conway was the evening's speaker for the annual meeting of the Dallas Zoological Society in October, and Curator of Publications Bridges gave the first lecture in the Ettie Jordan Memorial Program of the Zoological Society of St. Louis.

Dr. Kallman Heads Genetics Lab

Dr. Klaus D. Kallman has been appointed Research Associate in Genetics at the Aquarium and placed in charge of the Genetics Laboratory founded and made internationally famous by the late Dr. Myron Gordon. Dr. Kallman has been associated with the Laboratory since 1954. He is

a graduate of Queens College and New York University and was one of Dr. Gordon's most brilliant students. He is primarily a geneticist, but is also interested in the endocrinology and transplantation biology of fishes. Dr. Kallman has developed a successful technique of transplanting organs and tissues from one fish to another.

It Was a Busy Year for the Farm and the Children's Zoo

When the Farm-in-the-Zoo closed on October 12, it had recorded the largest number of visitors in any year — 116,539. Not only that, but the paid attendance set a new record of 96,812 persons. Organized educational groups are admitted to the Farm without charge on school days.

The Children's Zoo continued to draw more than 300,000 visitors; the exact number was 308,040 adults and children. It closed on November 13 for the winter months and will re-open at Easter.

New Exhibits and New Water Filter System for the Aquarium

Two large outdoor tanks, one of them 16 feet long with a capacity of more than 3,000 gallons, were put into operation at the Aquarium early in November for the exhibition of local marine fishes and invertebrates. Five smaller tanks are now also used for the same purpose.

Lobsters crawling in and out of rocky underwater caverns are, surprisingly, the exhibits that attract most visitors. They are the same species that can be seen on a bed of chipped ice in any fish shop, but the free-moving creatures, and their locomotion, appear to fascinate visitors. Some of the other exhibits are American Anglers, up to 30 pounds in weight; Squirrel Hake, large Cod, an Atlantic Sturgeon, Big Skates and Spiny Dogfish.

Work started soon after Labor Day on a new filter and water purification system whose primary purpose is to clarify and purify the water in the Oceanic Tank at the rate of 1,200 gallons a minute. Associated with it will be additional public walkways that will double the above-water viewing space. The job is expected to be finished by the end of May.

Immobilizing Drugs Being Used on Animals in Uganda

At the beginning of this year the Zoological Society made a contribution of \$7,000 from the African Wild Life Fund to Makerere College at Kampala, Uganda, for the development of immobilization techniques for use on wild animals. A report on the first six months of the project has now been received and the results are decidedly encouraging.

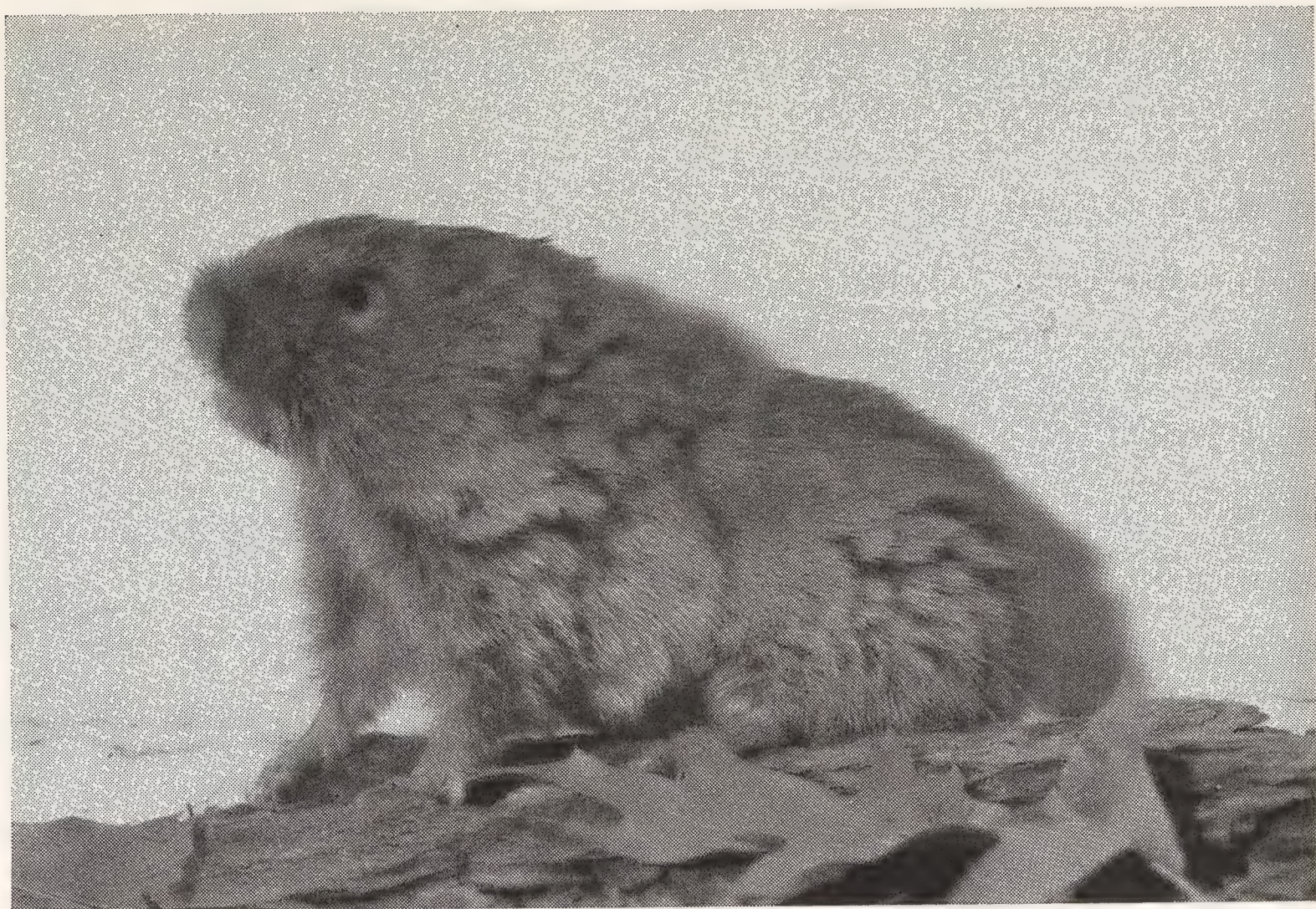
Immobilizing drugs (such as succinylcholine chloride) are now almost routinely used in American zoological parks when large, dangerous or "flighty" animals have to be examined or restrained, and the usual practice here is to fire a drug-filled syringe into the animal by means of a special type of airgun. The investigators in Africa are using a crossbow instead of an airgun.

Quick, safe (for man and animal) and easy as drug immobilization is in a zoo, it is many times more important on the plains of Africa where there is almost no other way of dealing with wild animals that have to be examined or moved. Experiences in zoos — and a considerable body of observations has accumulated — are of little help in the wild, for zoo animals and wild members of the same species often react quite differently to the drug dosages. African game management people therefore have to make their own tests and observations on as many kinds of animals as possible and it was to further this experimental work that the Society made its grant to Dr. A. M. Harthoorn and Dr. J. A. Lock of the departments of Veterinary Physiology and Medical Pharmacology of Makerere College.

Early in the period covered by the report a new drug combination was tried on giraffes on the Athi Plains and the results were such that the Kenya Game Department plans to take some of the Rothschild Giraffes off farm lands by immobilization and translocation, rather than by shooting.

In the Queen Elizabeth Game Park, 20 Hippopotamuses were immobilized "to try an experimental method of marking these animals in connection with the cropping schemes in the Park and on the Chambura," the report says. "Half of these animals got to shallow water before becoming immobilized but suffered no harmful effects. Two hippo failed to recover from the im-

An "odd-looking mouse" reported near the Lion House this fall turned out to be a Mole Pine Mouse (*Pitymys pinetorum scalapoides*) — a common resident of the area but one that had never been seen in the Zoo before. It is likely that a sizeable colony of Pine Mice lives in the brushy shelter bordering the Zoo's west side.



mobilization dose. Using our 'rhino' drug may reduce the mortality, but the carcasses can be regarded as part of the 7,000 of these animals that are due to be cropped."

Drs. Harthorn and Lock found that animals vary a great deal in their reaction to being "shot" by the syringe. "On the whole," they wrote, "the rhinoceros, elephant and hippopotamus tend to run, the antelopes and buffalo remain in sight. Occasionally an antelope will not appear to notice being struck by a dart while another will run fast. Sleeping hippopotamus do not always wake up as the dart strikes."

IN BRIEF

"Give that Turtle to the Zoo!" A recognized hazard of turtle populations in the New York-New England area is the small boy who goes away to summer camp, finds a turtle and can't resist picking it up and bringing it home at the end of camp. Pet turtles are not always welcome in New York City apartments and as a result many are presented to our Reptile House. This fall we acquired 111 specimens, mostly Red-eared and Box Turtles and most of them from disconsolate boys whose mothers had decided to draw the line at turtles. All such gifts are accepted — if not gladly, at least with good grace — and eventually a good many of the common local

species are liberated in the wild. Others are used in trades with foreign zoological parks.

Research Grants. Miss Jocelyn Crane of our Department of Tropical Research has been given a grant of \$9,000 by the National Science Foundation for the support of basic research on a "Comparative Study of the Fiddler Crabs (*Ocypodidae*, Genus *Uca*). The grant is for two years. The N.S.F. has also given the Zoological Society \$32,100 for basic research on "Calcification and Nutrition in Reef Corals" by Dr. Thomas F. Goreau. This grant, also, is for two years. Dr. Goreau is working in Jamaica under the general direction of Dr. Nigrelli of the Aquarium.

Teachers and the Zoo. The twenty-second In-Service Course for elementary and high school teachers began at the Zoo this fall. It is called "Utilization of the Bronx Zoo in the Science Program of Elementary and Secondary Schools," and 41 teachers are attending.

Baby Water Cobras. Earlier this year, a pair of African Water Cobras (*Boulengerina annulata stormsi*) were presented to the Reptile Department by Frank Delano, and in October they produced 20 young. Foreseeing a sizeable task in feeding so many babies, the department presented four snakelings to the Reptile Department of the American Museum of Natural History, and four to the Philadelphia Zoo. So far, one or

two of the remaining 16 have consented to take small pieces of fish.

PUBLICATIONS OF INTEREST

THE WONDERS I SEE. By John K. Terres. Illustrated (drawings) by Walter Ferguson. 256 pp. Lippincott, Philadelphia and New York, 1960. \$5.00.

The editor of *Audubon Magazine* has brought together some four-score essays on out-of-doors happenings, all under titles that compel interest. Who could resist reading about "How a Kodiak Bear Cuts Apples" or "Can Snakes Hear?" or "Where Do Birds Sleep at Night?" A very readable (and informative) book, indeed.

THE SCIENTIFIC AMERICAN BOOK OF PROJECTS FOR THE AMATEUR SCIENTIST. By C. L. Strong. 584 pp., 256 drawings and photographs. Simon & Schuster, New York, 1960. \$5.95.

"Amateur scientists" are no longer kids fooling around with homemade telegraph instruments and collections of arrowheads. This is a book of "experiments and constructions, challenges and diversions" in Astronomy, Archaeology, Biology, Natural Sciences, Earth Sciences, Mathematical Machines, Aerodynamics, Optics, Heat and Electronics, reprinted and enlarged from the practical monthly section in *Scientific American*. Under "Natural Sciences" there are chapters on Walker Van Riper's work with hummingbirds, on raising moths and butterflies as experimental animals, on bird-banding and on keeping reptiles and amphibians.

WILD ANIMALS OF NORTH AMERICA. Edited by Merle Severy, chapters by 14 authors. 400 pp., 409 illus., 258 in color by Walter A. Weber, Louis Agassiz Fuertes, Carl Rungius, and other artists and photographers. The National Geographic Society, Washington, 1960. \$7.75.

Prodigiously illustrated (with so many color plates that the black-and-white photographs come almost as a relief) and written in the anecdotal but informative style of the *National Geographic*, this latest in the magazine's book series matches the high standards of the others. Five paintings by Rungius are reproduced from the New York Zoological Society's collection. First printing was 200,000; most will be gone the day after Christmas!

SHAG: Last of the Plains Buffalo. By Robert M. McClung. Illustrated by Louis Darling. 96 pp. William Morrow & Co., New York, 1960. \$2.95.

There is a great deal of excellent natural history in this moving and dramatic story of one of the last of the Buffalo. It is a formula Mr. McClung has handled excellently in previous books. Recommended for young people.

THE CHILDREN OF LILITH. By Guy Piazzini. Translated by Peter Green. 192 pp., 40 photographs, maps. Dutton & Co., New York, 1960. \$5.95.

A super-heated account of a French ethnological expedition to Borneo. On the way, the party looked in on the Komodo Monitors and had literary shivers over them. Good photographs.

WIDEAWAKE ISLAND. By Bernard Stonehouse. 224 pp., 36 photographs. Hutchinson & Co., London, 1960. 35 shillings.

A pleasantly anecdotic account of 18 months spent on Ascension Island in the mid-Atlantic by a British Ornithologists' Union Centenary Expedition, studying sea-birds.

New Members of the New York Zoological Society

(Between September 1 and October 31, 1960)

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Royal Little

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Supporting

Mrs. Louis K. Anspacher

John C. Jaqua, Jr.

Dr. David H. Schonholz

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Miss Dorothy Abrahams

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Mrs. Irene Roussakis

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John C. Schmid

Dr. Robert J. Sluka

Mrs. Bernard Sunshine

Louis Suozzo

Carson Ross Whiting

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Well, you can dream, can't you?

IDEAS are apt to be more rosy than realistic at the first Staff Meeting at the Zoological Park in November, because that's when our Curators start planning the animal show for the Members' Party at the Waldorf-Astoria (this coming January 9). Under the relaxed guidance of President Osborn, bold and beautiful projects and plans are proliferated with unprofessional abandon.

"If," Aquarium Curator Jimmy Atz might say, "the Waldorf floor could support a glass tank big enough for Olaf to swim in, we could . . ."

"Why not another tank for Ookie?" suggests Curator Bill Bridges. "It could be a little smaller than Olaf's, so . . ."

"And what a show" (this from President Osborn) "it will be to see about fifty Waldorf waiters busy all night opening clams for them!"

"Well," Mammal Curator Joe Davis begins, "January 9 is about the time the three kings came to Jerusalem. Suppose we put early-Christian-era trappings on our three dromedaries, paint a . . ."

"If you want to get historical," Bird Curator Conway might break in, "why not show the story of flight? We'll begin with a model of Archaeopteryx and end with an albatross in full flight. All you have to do is to build a transparent wind tunnel with a wind velocity of about 90 MPH, and the albatross will soar in it just as he does over the trackless Pacific. But in the Waldorf exhibit, there he'll be right there before your eyes, just right there for days and days and . . ."

"Gentlemen," Dr. Osborn is apt to say at this point, "get serious. January 9 will be here before you know it. And let's remember that our budget this year, as usual, is a tight one. Comptroller Schiemann, do you want to comment on that?"

And so, the Curators draw up their chairs to the table, and take out their pencils.

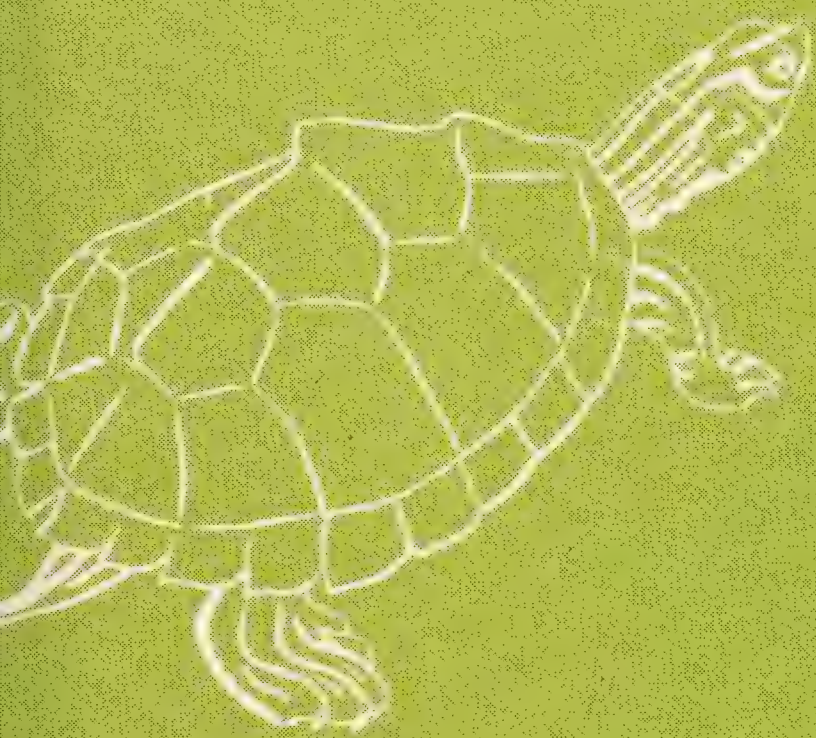
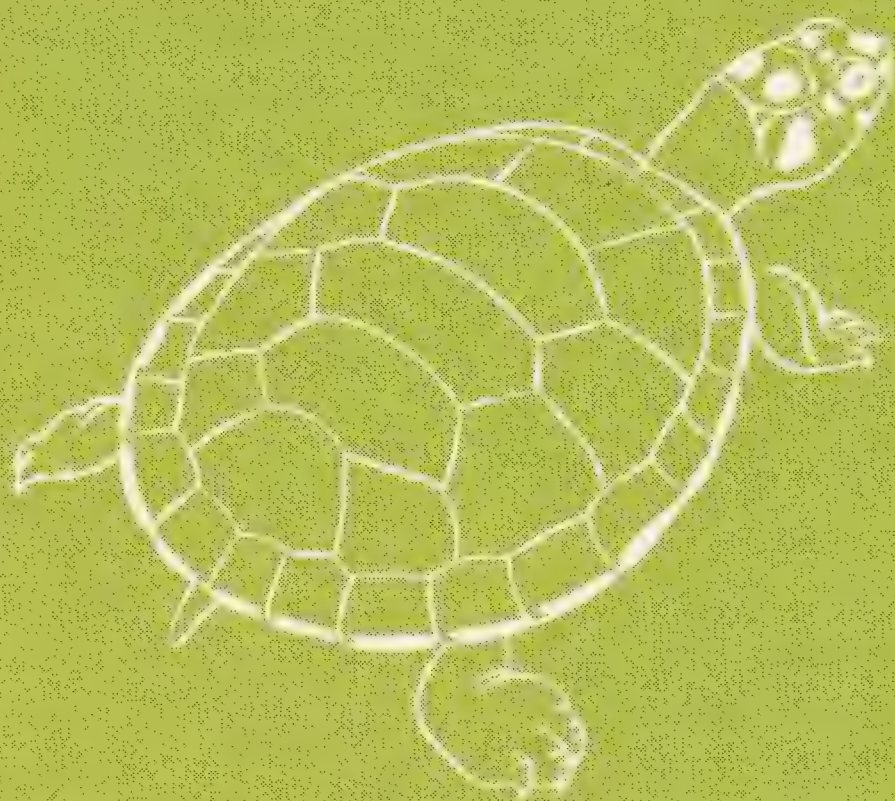
We can't tell you now exactly what they're planning (at this writing the Mammal, Bird and Reptile departments are still squabbling over top billing), but we *can* promise a dramatic group of thrilling living exhibits.

May our exhibits and program also thrill your guests! For this Meeting's guests should be next year's new Members.

MEMBERSHIP DEPARTMENT
The Zoological Park
New York 60, N. Y.



THE CARE OF PET TURTLES



By

HERNDON G. DOWLING

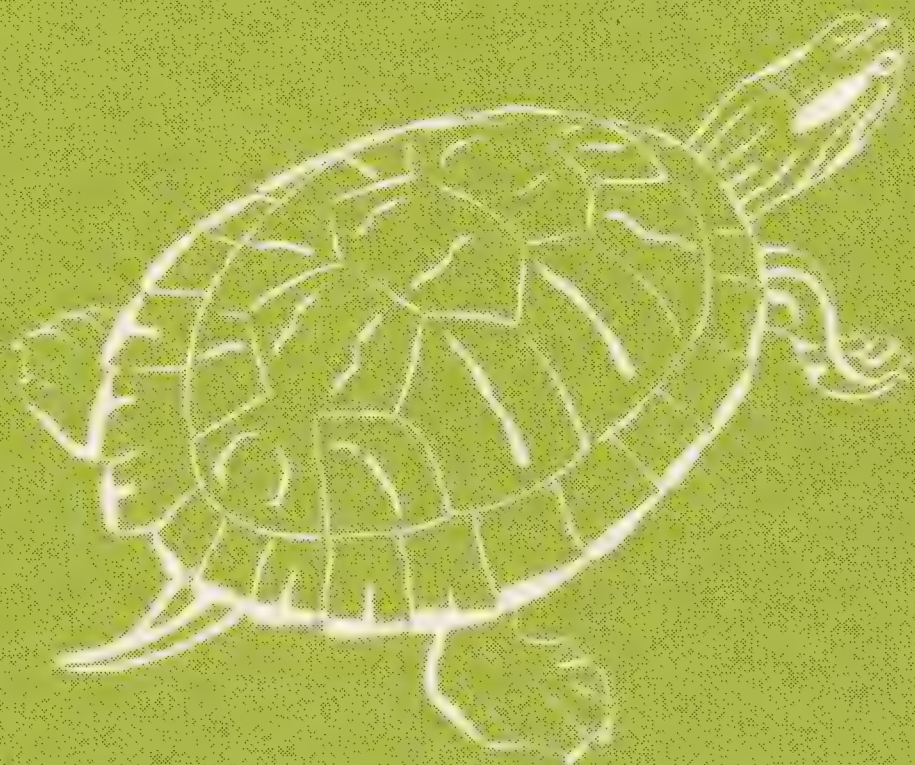
Curator of Reptiles

&

STEPHEN SPENCOOK

Head Keeper of Reptiles

**NEW YORK
ZOOLOGICAL
SOCIETY**



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Introduction

PET TURTLES deserve a better fate than to be chilled to death in city tapwater, roasted in apartment windows or slowly starved to death on commercial "turtle food." Yet that is what happens to vast numbers of them. Some animals have comparatively great capacity for adaptation to life in captivity, but not turtles. Ultra-conservative in their approach to life, they were already established in their shell-protected forms by Triassic time, 160 million years ago. They saw the coming of the gigantic dinosaurs, perhaps dodged their footsteps, and watched while they struggled their way to extinction 100 million years later. They were there when *Archeopteryx*, the first bird, tried its feathered wings; saw pterodactyls make the other great experiment in flight, and fail; and were already ancient when the first shrew-like mammals appeared. That innovation of the last million years, man, may well destroy himself before these curious and cumbersome beasts are ready to take on any basic change in their structure and way of life.

In Europe the reptiles of this order are neatly divided into tortoises (typical land turtles), terrapins (hard-shelled freshwater turtles) and turtles (sea turtles). Because many kinds in other parts of the world — side-necks, soft-shells, snappers, etc. — do not fit these categories, most American naturalists use the term "turtle" in a broad sense to include them all. We have followed this practice in this booklet.

The information in this booklet is not intended for the fully-fledged testudophile, who may have kept a turtle for 30 years or more and who may know better than anyone else how to care for his particular charge. It is written for the novice, the person who has recently (accidentally or otherwise) become the owner of a turtle, the person who intends to buy a turtle, or for the person who has owned a turtle for some time but feels that his pet may not be getting proper care.

Further, it does not claim to solve all the problems of turtle-keeping, since in reality the basic requirements of turtle health are still little known. Also, there are more than 200 species of turtles living today. Each may have its own particular requirements — and even the various geographic races of a single species may differ in their habits.

However, most of the kinds of turtles commonly sold as pets in the United States have roughly similar needs. While we believe that the directions given here will be helpful in the care of almost any turtle, they are written with the common "pet" species particularly in mind.



Fig. 1. Hermann's Tortoise (*Testudo hermanni* Gmelin), showing the two parts of the shell: Carapace (upper) and Plastron (lower).

What Is a Turtle?

Turtles are reptiles. This means that they are ectothermic, backboned animals that breathe by means of lungs and have horny scales. They lay eggs that are fertilized internally and are protected from desiccation by layers of membranes. The term “ectothermic” means that, unlike mammals and birds, these animals do not produce sufficient heat within their bodies to withstand cold. Instead, they must depend upon an outside source such as sunlight for their body heat.

Further, turtles have features of their own that distinguish them from other reptiles — the lizards and snakes, the crocodilians, and the lonely Tuatara. For this reason they are set apart in a separate order, the Testudines, one of the four orders of living reptiles. Indeed, turtles are so peculiarly constructed that if they were extinct and known only from fossils, they would vie with dinosaurs and pterodactyls as curiosities.

The body of a turtle is enclosed by a pair of bony shells — the *carapace* above, formed from flattened ribs and other bones, and the *plastron* below (Fig. 1). In the process of protecting the rest of the body in this bony box, the turtles have performed a remarkable feat, unmatched by any other animal. They have pulled the entire shoulder girdle, as well as the pelvic girdle, inside the rib-cage.

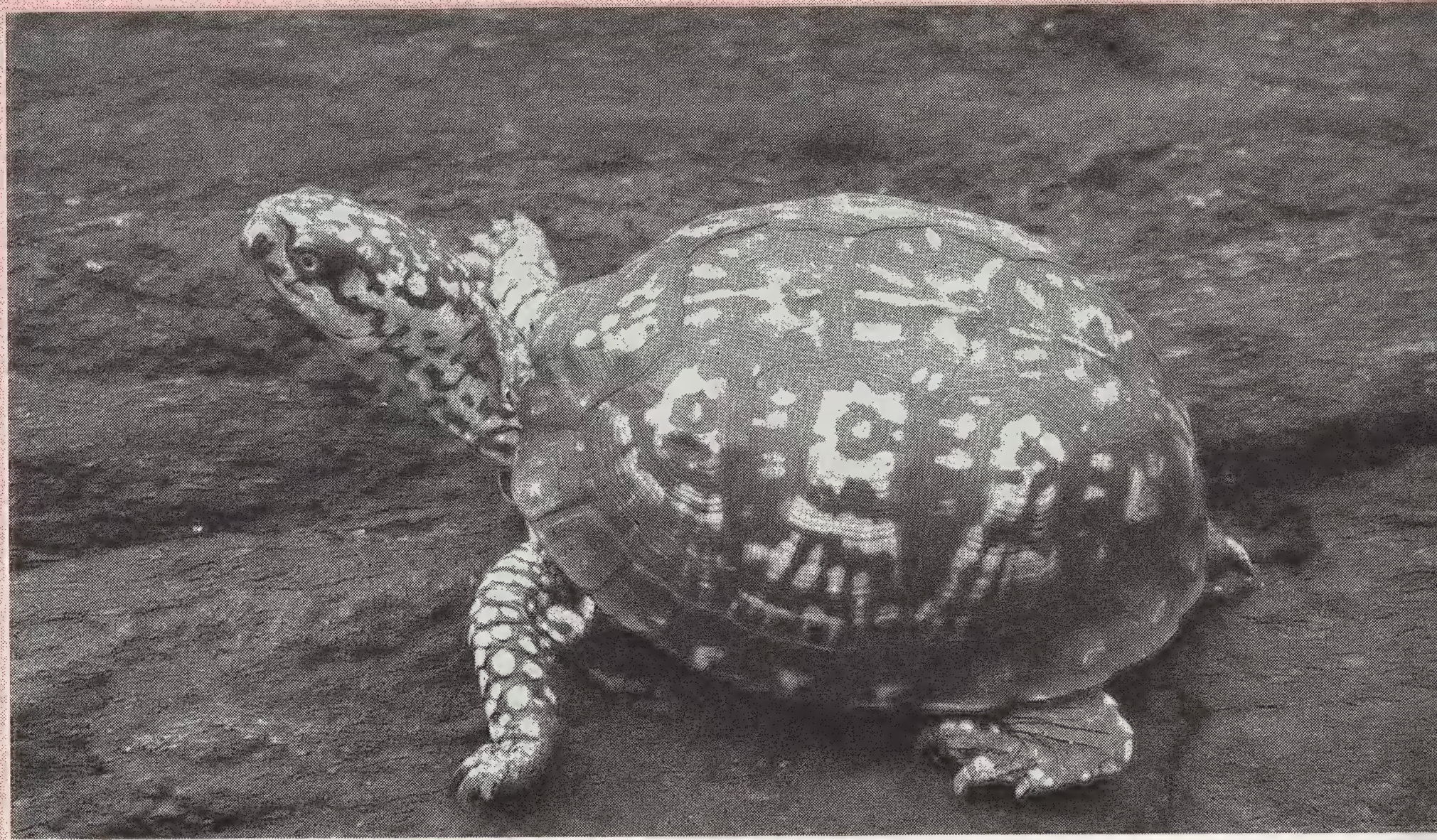


Fig. 2. Box Turtle (*Terrapene carolina* Linnaeus), a species in which the plastral hinges allow the turtle to withdraw completely.

Like birds, turtles lack true teeth. The edges of their jaws are covered with horny sheaths to form a beak. Some turtles, however, have the beak serrated into tooth-like saw edges.

Land turtles are the best-protected and Box Turtles (Fig. 2) have carried protection to the ultimate. With a large, doubly-hinged plastron, they are able to close up into a bony box that fully protects head, limbs and tail. Aquatic turtles such as sea turtles and soft-shell turtles (Fig. 3) are at the other extreme. They have lost many of the protective features of their shell in the streamlining and loss of bone that is so often correlated with life in water. Pond turtles, the kinds usually sold at pet stores, fall between these extremes. While lacking the hinge in the plastron, and thus being unable to close their shell, they nevertheless receive considerable protection from their bony and horn-covered shells.

What Kind of Turtle Do I Have?

There are 210 species of turtles living today but only about ten kinds are commonly sold as pets in the United States. If you captured your turtle in the wild, it might be any one of the 37 species that inhabit this country. In this case we suggest that you consult one of the identification guides listed at the end of this paper. Knowing what you have may be more important than you realize, since several states have laws prohibiting the capture or retention of certain species. You cannot legally keep native Wood Turtles (*Clemmys insculpta* Le Conte) or Eastern Box Turtles in New York, or native Diamond-back Turtles (*Malaclemmys*) of certain sizes in New Jersey.

The vast majority of the hundreds of thousands of baby turtles sold as pets each year are of two kinds. The Red-eared Turtle (Fig. 5) is by far the most common species sold, and the next most common is probably the Mississippi Map Turtle (Fig. 6). Other North American forms that are rather commonly seen are the Yellow-bellied Turtle (Fig. 7), the False Map Turtle (Fig. 8), the Florida Cooter (Fig. 9) and the Painted Turtle (Fig. 10).

In recent years, probably due to depletion of our native kinds in the southern swamps, several exotic pond turtles have found their way to our "pet trade" markets. Among these are one from North Africa (Moorish Pond Turtle, Fig. 11), one from South America (Yellow-spotted Amazon Turtle, Fig. 12), and two from Japan (Japanese Pond Turtle, Fig. 13, and Reeves's Turtle, Fig. 14). Two land-turtle newcomers to the pet trade — so far found only in a few of our larger cities — are Greek Tortoises (*Testudo graeca* Linnaeus) and Hermann's Tortoise (*Testudo hermanni* Gmelin) from southern Europe. We may expect others to appear on the market as air transportation becomes less costly and our native turtles become more difficult to obtain.

Male or Female?

It is difficult to determine the sex of a baby turtle. Most of the features that can be used in sex determination do not appear until the turtle is mature, but the tail length and the position of the cloacal opening ("anus") differ. In males the tail is long and tends to be thick, while the cloacal opening is out beyond its base, often out to the margin of the shell. In the females the tail is relatively short and thin, and the cloacal opening is at or near its base.

Fig. 3. Spiny Softshell (*Trionyx spinifer* Le Sueur), showing the streamlined form of the body.



In mature turtles the plastron of the male is commonly somewhat concave, while that of the female is flat or slightly convex. Some turtles have additional sexual differences when mature. Male Box Turtles often have red or yellow spots in the iris of the eye while the eyes of the females are unicolor brown. The males of many of the pond turtles, such as the Red-eared Turtle and the Painted Turtle, have extraordinarily long nails on their fore-feet, while those of the females are not appreciably longer than those of the hind feet.

Eggs, Growth and Longevity

In nature turtles commonly lay their eggs as a single clutch in a well-prepared flask-shaped hole in the sand or soil of some sunny slope. This is rarely possible in most captive situations and the turtle may lay its eggs singly in the water or on land over a period of a week or more. If they are fertile (and turtles may lay some fertile eggs for as long as three years after mating) and not laid in the water, where the embryo soon drowns, these eggs may be hatched by placing them in damp (but not soggy) sand, sandy-loam or sawdust and keeping them at temperatures of 80° to 90° F. Keep in mind, however, that the incubation period is commonly between 60 and 90 days. The baby turtles will dig out of the sand after hatching (Fig. 4).

The turtles sold at pet stores are usually hatchlings of the year. Often they have hatched within the month. Even if they are older they ordinarily have received so little food that they are no larger than a newly-hatched turtle. In nature turtles of this size — about the diameter of a half-dollar — will double their dimensions during the first three or four months of the growing season. Given proper conditions they will do this in captivity as well. This rapid growth continues until sexual maturity is attained. Red-eared Turtles reach maturity in about five or six years, when they have carapace lengths of 6 to 9 inches. Growth does not cease at this time but it continues at a much reduced rate throughout the lifetime of the turtle.

Turtles, if well cared for, tend to outlive their owners and the exact ages of old turtles are difficult to obtain. The age of such species as Box Turtles and Wood Turtles that live in the northern states may be estimated for relatively young individuals by counting the growth rings on the scutes (horny plates on the shell). After about 10 to 15 years the scutes begin to wear off, however, and only a minimum age estimate is possible. Even this cannot be done for pond turtles, since they moult their scutes each year. In captive turtles, of course, the growth rings may bear no relation to seasonal changes.

Turtle ages are commonly overestimated or overstated. It is certain,

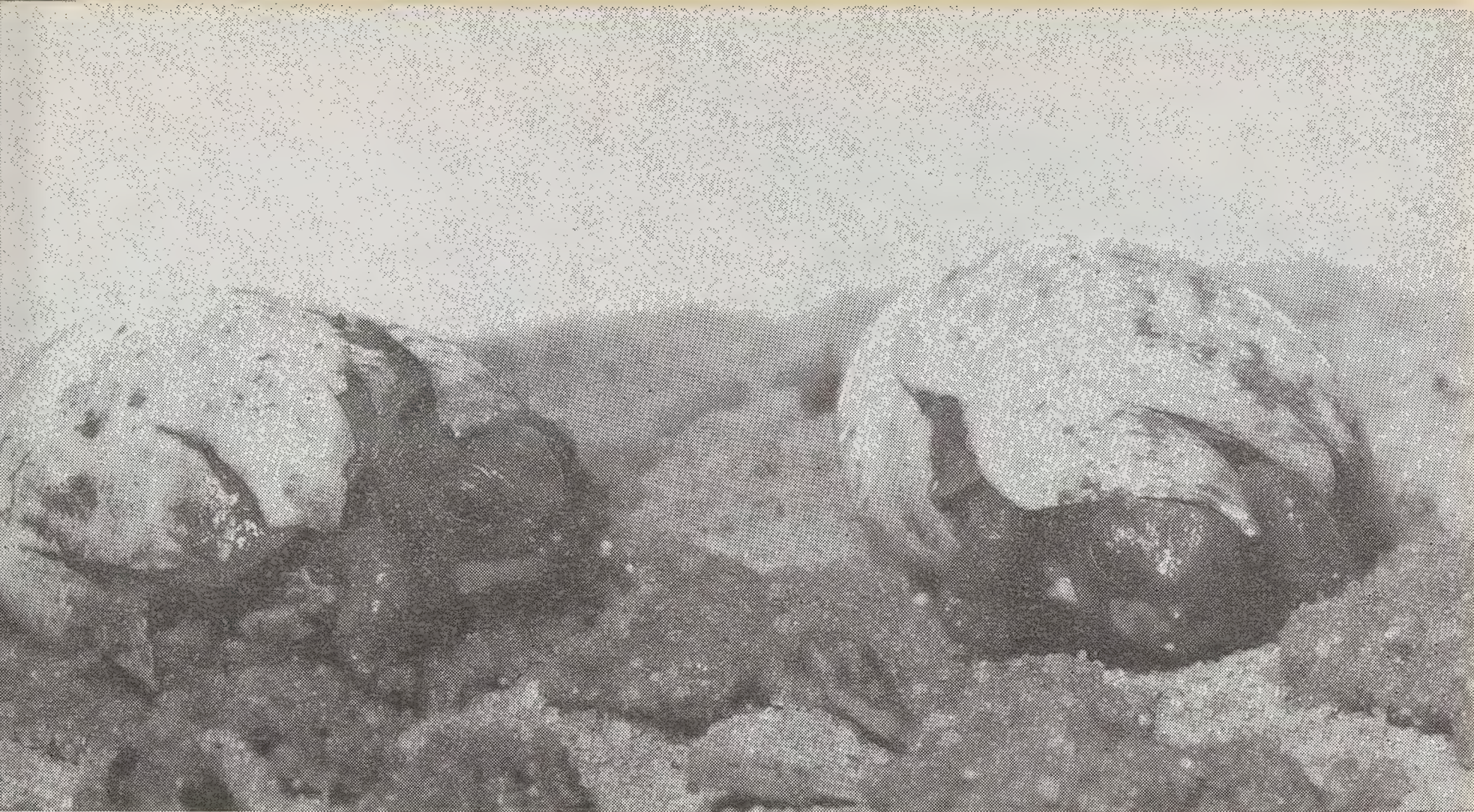


Fig. 4. Box Turtle (*Terrapene carolina* Linnaeus) hatching. The eggs were deposited on June 25 and they hatched between Sept. 26 and Oct. 4.

however, that many of the Red-eared Turtles sold as pets live as long as 15 years, and some live for 25 years or more. Records exist that credit at least one Box Turtle with an age of 129 years.

Basic Requirements of Turtles

Turtles are tough animals but even so they have certain basic living requirements that must be met. The pond turtles and river turtles that are commonly sold as pets are mainly of southern origin. The conditions under which they should be kept include the following:

- (1) They must be maintained at rather high temperatures (75-85° F.).
- (2) They require a diet with relatively large amounts of calcium.
- (3) They need sufficient water to immerse their heads completely so they can swallow their food properly.
- (4) They require an area where they can crawl out of the water and get completely dry.
- (5) About 8 hours of bright light (but not in direct sunlight) each day seem necessary.
- (6) Sufficient space for considerable movement is desirable. In general one square foot of enclosure should be allowed for every 4 linear inches of turtle. Thus, an average turtle bowl of one-half square foot will maintain two baby (inch-long) turtles, or it would take a two-square-foot enclosure to maintain an adult (8-inch) Red-eared Turtle under proper conditions of space.

Ways of meeting these requirements are discussed in the following sections.

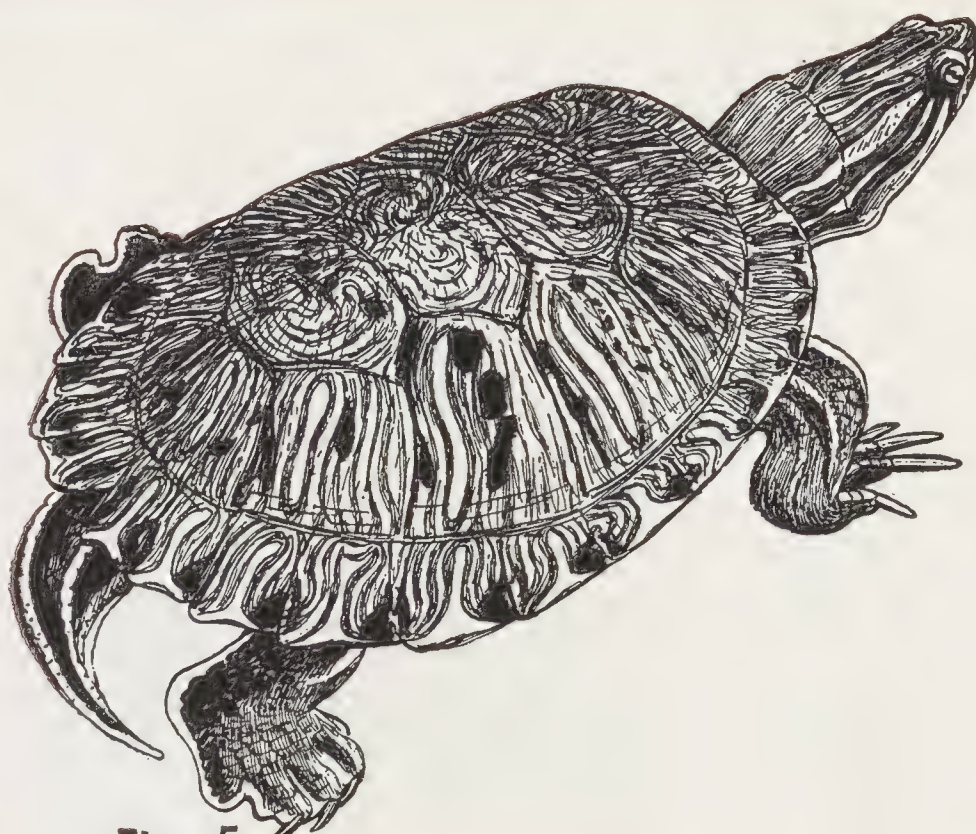


Fig. 5

Red-eared Turtle, *Pseudemys scripta elegans* Wied. Mid-southern United States. Low green carapace; longitudinal red mark behind eye; a dark blotch on each plastral scute.

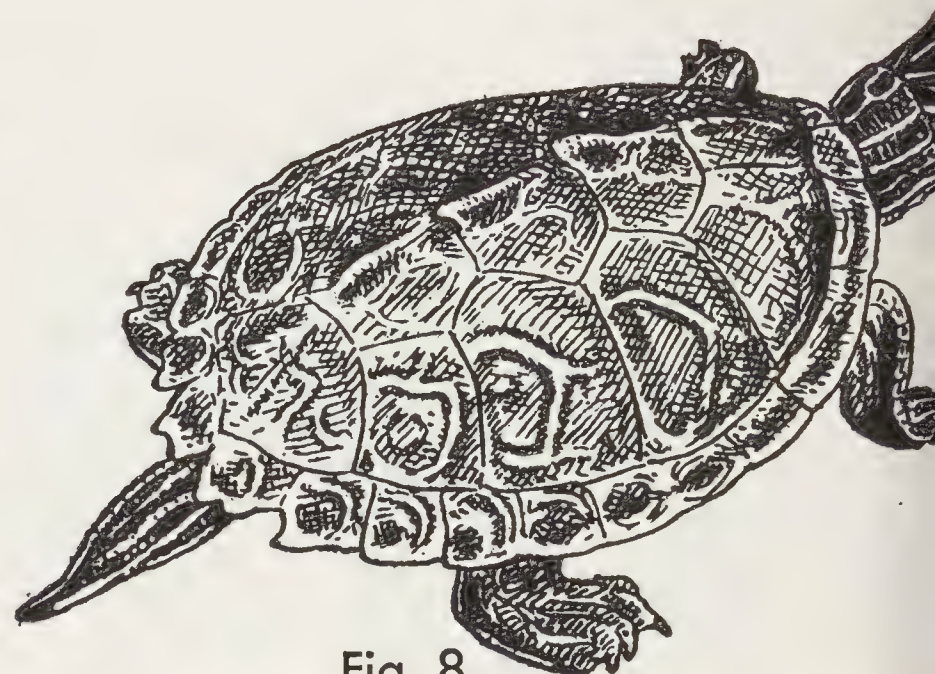


Fig. 8

False Map Turtle, *Graptemys pseudogeographica* Gray. Central United States. Knobbed and keeled carapace; small light lines extend from neck to eye; dark markings on plastron tend to follow margins of scutes.

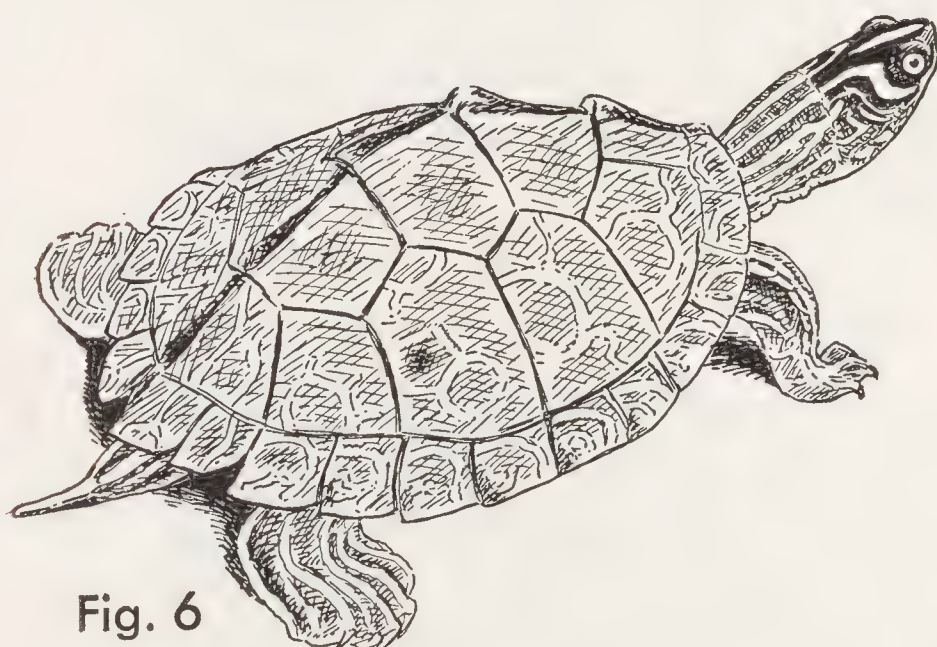


Fig. 6

Mississippi Map Turtle, *Graptemys kohni* Baur. Southeastern United States. Knobbed keel on carapace; vertical yellow crescent behind eye; plastron with broad, open-centered, dark markings.

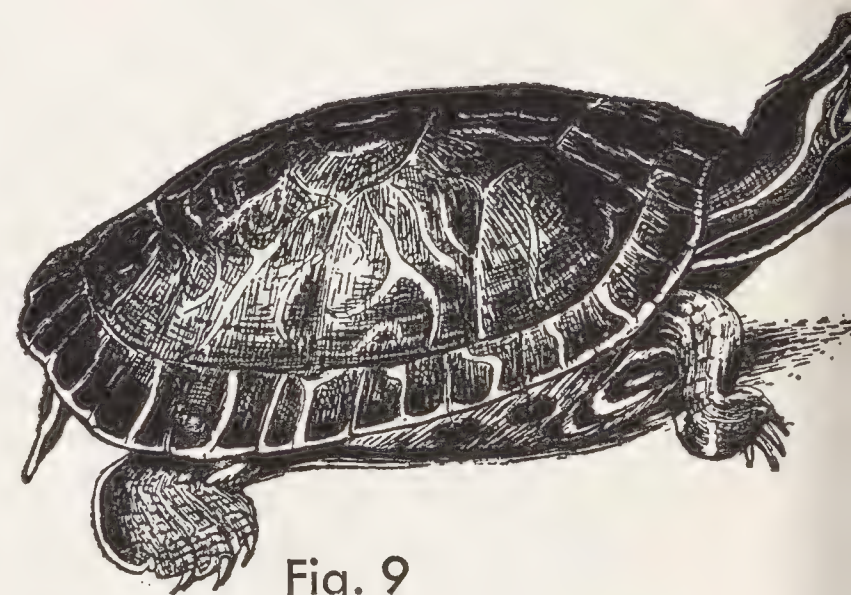


Fig. 9

Florida Cooter, *Pseudemys floridana* Le Conte. Coastal Southeastern United States. Low, yellow-marked, green carapace; narrow yellow stripes from neck to eye; yellowish plastron.

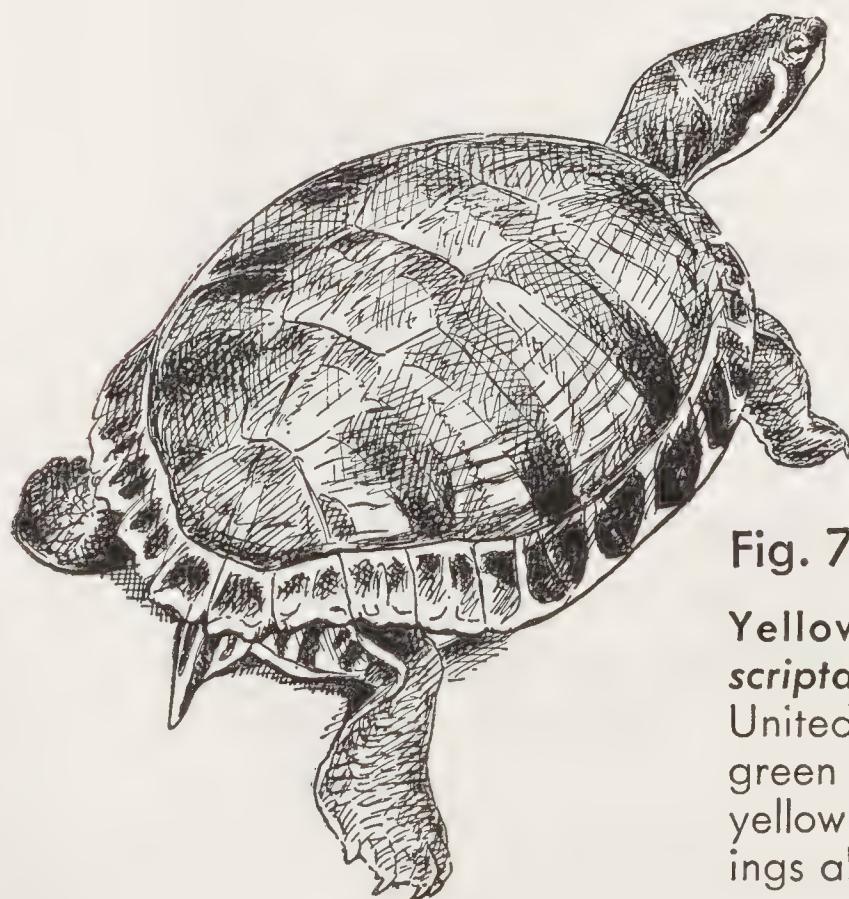


Fig. 7

Yellow-bellied Turtle, *Pseudemys scripta scripta* Schoepff. Southeastern United States. Low, yellow-marked, green carapace; broad longitudinal yellow mark behind eye; dark markings absent from some plastral scutes.

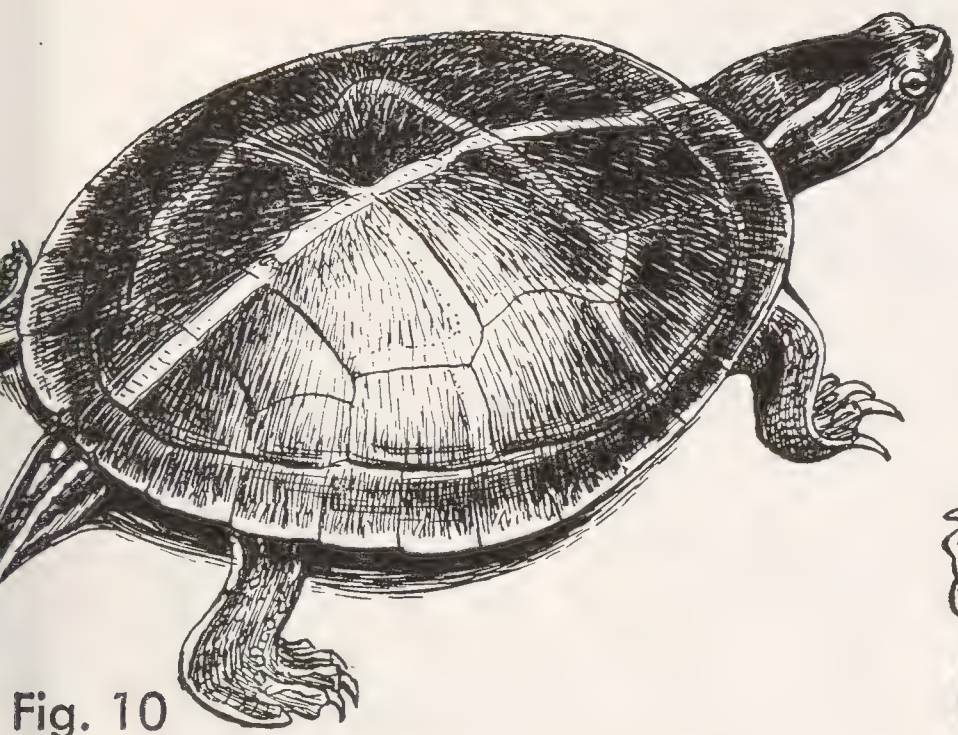


Fig. 10

Painted Turtle, *Chrysemys picta* Schneider. Eastern North America. Low, dark carapace with red- and black-marked margin; yellow marks behind eye; plastron orange or reddish, sometimes with dark central mark.

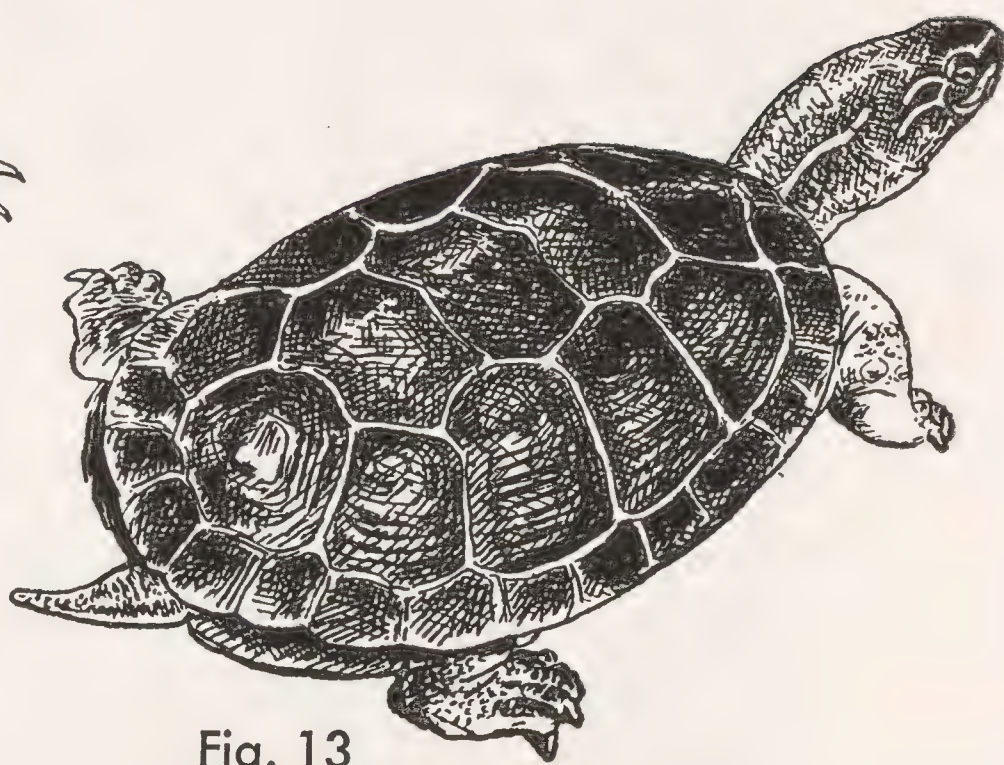


Fig. 13

Japanese Pond Turtle, *Clemmys japonica* Temminck & Schlegel. Southern Japan. Low, dark, rough carapace; olive head without light markings; plastron unicolor black.

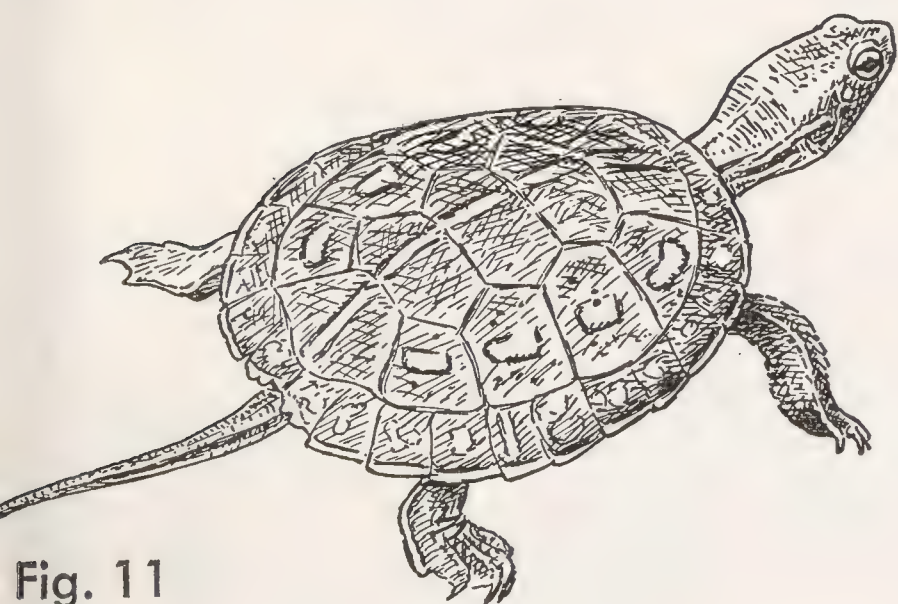


Fig. 11

Moorish Pond Turtle, *Clemmys leprosa* Schweigger. Mediterranean region. Brown carapace with low keel; small light spot and stripes behind eye; plastron dark with broad light margins.

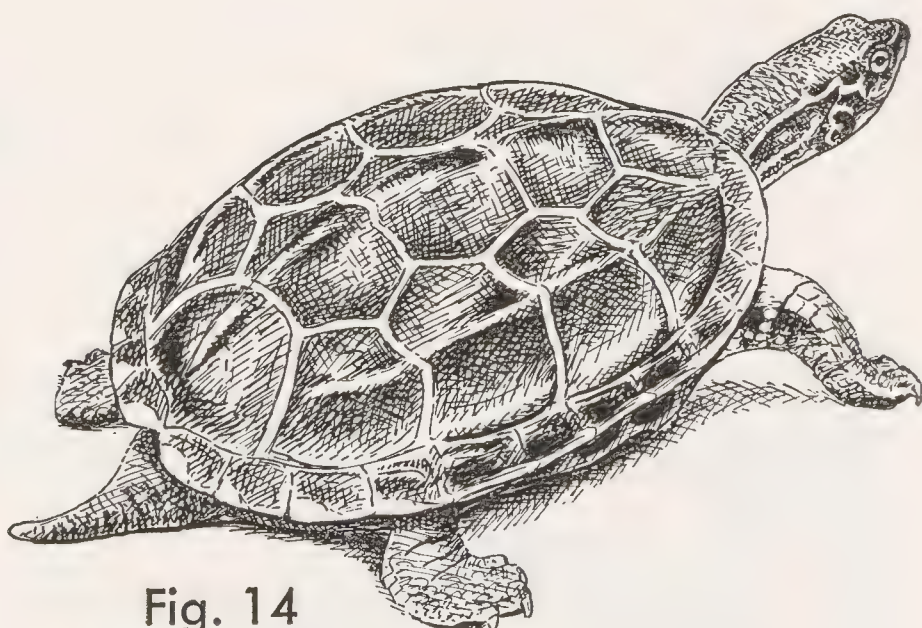


Fig. 14

Reeves's Turtle, *Chinemys reevesi* Gray. Eastern China and Japan. Dark brown carapace with three sharp keels; indistinct light markings on side of head; plastral scutes black with narrow light margins.

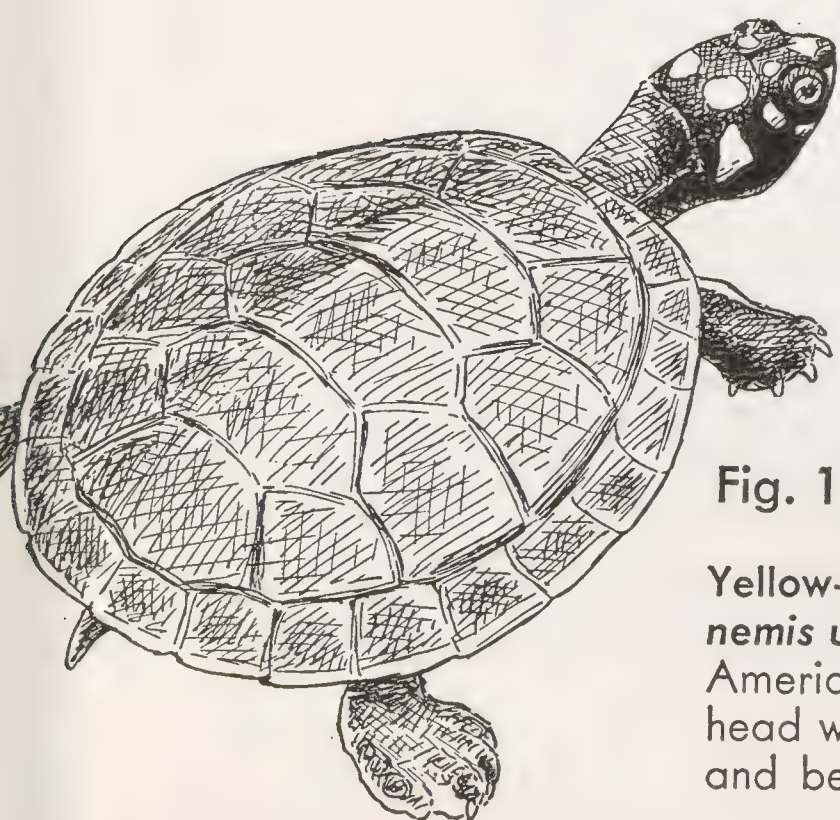


Fig. 12

Yellow-spotted Amazon Turtle, *Podocnemis unifilis* Troschel. Northern South America. Carapace rounded, olive; head with yellow spots on nose, beak, and behind eye; plastron light gray.

The Enclosure

Any number of differently designed enclosures may be used in keeping pet turtles so long as their basic requirements are met. A container of simple construction that does not have a large number of parts which must be removed for cleaning is preferable. Since turtles eat organic materials that decay fairly rapidly, relative ease in cleaning the container is important — for the benefit of the owner if not for the health of the turtle.

Most of the commercially available plastic “turtle bowls” are adequate for the care of baby turtles, with the simple addition of a desk lamp (Fig. 15). These enclosures are fairly easy to clean, and with an inch or so of water will serve admirably for one or two of the typical pet-store-sized turtles. The desk lamp with a 60-watt incandescent light bulb should be placed so that the bulb is *eight to twelve inches* above the *land area* of the bowl. This allows the animal to “sun” sufficiently to rid itself of moisture that might otherwise serve as a medium for the growth of fungus or bacteria.

A simple rectangular aquarium (Fig. 16) with a slanting, close-grained rock near one end, or a larger one with a stone in the middle, makes an easily cleaned container for these turtles. Several turtles may be kept together if their general space requirements (see “Basic Requirements”) are maintained. Even a glass baking dish with a stone in one end may be used.

Such simple and easily-cleaned enclosures are typical in America. Europeans, however, prefer more natural-appearing settings for their pets. Many different — and quite elaborate — turtle enclosures are described and pictured by Klingelhöffer (see “Bibliography” on page 16 of this booklet).

Unfortunately for the appearance of turtle enclosures, it is not possible to use water plants as a background with which the turtle has contact. Almost all of the species commonly sold as pets are at least partly vegetarian, and many primarily so, and even a small turtle in a large aquarium can eat an amazingly large amount of plant material. A recently developed method of enhancing the appearance of the enclosure with plants is provided by U-shaped plastic strips into which a glass plate may be inserted to separate the plants from the turtles.

Unlike the containers for most pet animals, that for a turtle does not need to be covered. In fact no glass plate or other solid object should be placed over the top unless it is absolutely essential for maintaining the proper temperature. Covering the enclosure allows the humidity to reach too high a level and does not allow the turtle to become dry. This



Fig. 15. Commercial "turtle pond" with desk lamp. This type of enclosure is adequate if sunning-rock is not too slick.

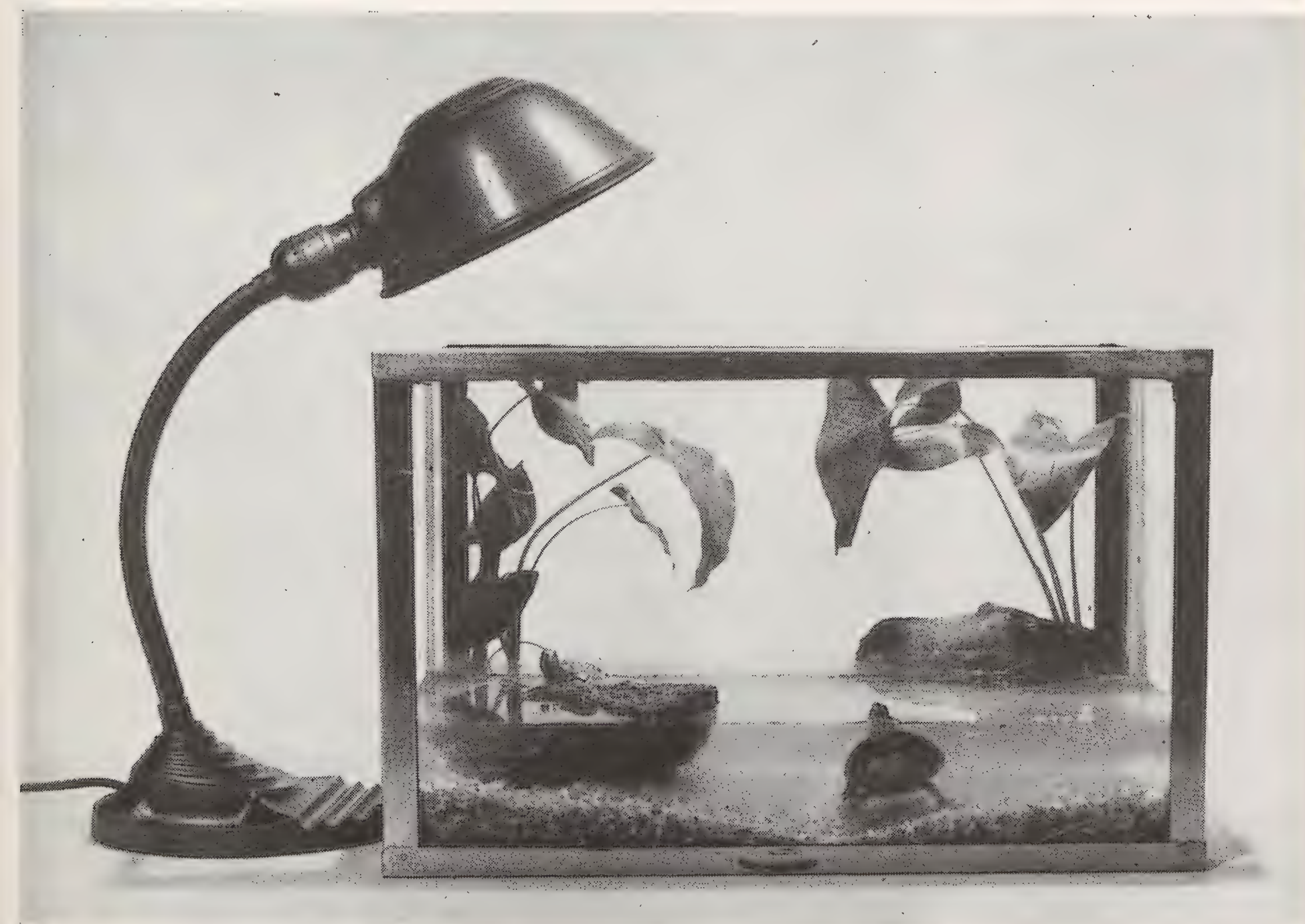


Fig. 16. An aquarium with a sunning-rock provides an adequate enclosure. A glass separator allows maintenance of a planted background.

situation often leads to growths of bacteria or fungus on the animal that may cause its death.

We advise against setting the turtle bowl or enclosure in a window. While sunlight may be beneficial, the extreme temperatures and drafts of cold air common to window ledges make them an unduly hazardous location for the well-being of any temperature-sensitive animal. The dangers involved are greater than are warranted by the possible benefits.

Outdoor enclosures may be used for large turtles during warm weather but adequate provision must be made to prevent their escape or injury by other animals. Particular attention must be given to providing some shade throughout the day, since a relatively short exposure to direct sunlight can overheat the turtle and cause its death if it is unable to find cover.

General Care

Some turtle owners like to feed their charges every day, while others reduce the feedings to once or twice a week. In the New York Zoological Park we find that feeding three times a week is adequate to assure normal growth of the turtle, and at the same time does not impose too restrictive a program on the owner. Of course one of the more pleasant aspects of keeping turtles is that they are not too demanding of regular care. If the owner wishes to go on a month's vacation, it is not necessary to make special provision for regular feedings. If warmth and water are available, a month's fast will not harm a healthy pet.

Feeding. Two general plans of feeding are possible. One is to remove the turtle from its usual quarters and feed it in a smaller container. This is a particularly valuable method if the regular enclosure has more than minimal background material. By feeding in a separate container the number of times the regular enclosure must be cleaned can be reduced to once a week or less.

The more usual method is to remove the sunning-rock and other background material from the enclosure and feed the turtle in its own tank. The turtle should be given all it will eat at one time (see "Food and Feeding"), a sufficient time should be allowed for it to complete the meal, and then the enclosure must be cleaned thoroughly.

Cleaning. Thorough cleaning includes removing all of the uneaten food, making sure that none of the surfaces of the enclosure or its contents are greasy, and that no bacterial growth has become established in a little-used corner. Such cleaning usually requires removing all background material, pouring out the water and washing the enclosure and its contents with soap and water. Grease on the enclosure or sunning-rock tends to foul the water.

Water. The water that is used to fill the tank should be lukewarm (75-80° F.). Cooters, for example, are southern turtles and require relatively warm water for normal activity and growth. Some owners who are careful in every other way forget that the tapwater in northern cities is often as low as 50°, which is much too low for these animals.

Schedule. When the water, the sunning-rock and the turtle are back in the enclosure and the light is replaced over the land area, the turtle is ready for another two- or three-day period. A schedule of turtle-feeding about two hours before the family meal allows the enclosure to be cleaned along with, or after, the family's dishes. This routine appears to be a good one in a busy family.

Food and Feeding

Most of the turtles sold at pet stores are omnivorous; they eat both plant and animal material. In nature their food is a variety of aquatic vegetation that is supplemented with worms, insects, crayfish, tadpoles, fishes and other organic material. Other than these natural foods we know little of their basic dietary needs. The only readily definable mineral requirement is calcium, which is needed for the growth of bones, including those of the shell. The other parts of the diet suggested for captive specimens have been determined empirically — we know that turtles do well if given these elements and do not if they are omitted.

Standard Diet. A standard meat-and-vegetable mixture is offered all turtles at the New York Zoological Park other than those kinds known to be entirely carnivorous. The food items are chopped to a size less than the dimensions of the head of the smallest turtle in the group — but not so small that the turtles have difficulty in grasping them. At least *one food item from each* of the three categories below is necessary for a complete diet. The first-named food is the one generally used in the Zoological Park.

- (1) *Vegetables:* green lettuce, carrots, tomatoes, kale, water cress.
- (2) *Fruits:* bananas, apples, peaches, oranges, strawberries, cantelopes, watermelons.
- (3) *Meat:* chopped whole fish, shrimp, lobster, chopped beef, beef heart, liver, canned dog-food.

Chopped green lettuce is used as the base. Smaller amounts of the seasonally available fresh fruits and other vegetables are added. A still smaller amount of raw meat is sprinkled over the top of the mixture. A shallow metal pan is used in feeding numbers of turtles. However, if only one or a few small turtles are to be fed, the diet may be put on a lettuce leaf, and placed at the water's edge or directly in the water.

Minerals and Vitamins. The above diet produces normal growth in most turtles. However if meat other than chopped whole fish is used, additional calcium and perhaps vitamins as well should be added.

The need for large quantities of calcium in the rapid growth of such a many-boned animal is obvious. A small ball of Plaster-of-Paris placed in the water is often suggested for this purpose. Presumably a cuttlebone such as that used for canaries would serve also. However, perhaps the easiest and most direct method of insuring adequate amounts of calcium in the diet is to sprinkle a pinch of bone-meal on the meat and rub it in so that it does not wash off. Bone-meal is sold at most variety stores for use with potted plants, and a 15-cent box of it will last a long time.

Little is known of the vitamin needs of turtles. However, experiments in the Bronx Zoo have shown that chopped whole fish gives greater turtle growth than other types of meat. Besides bone, the chopped fish includes the liver and other visceral organs and thus supplies a greater variety of foods than the muscle alone. Therefore, if other meats are fed regularly, it may be found helpful to add a drop or two of cod-liver oil or other vitamin supplement to the food.

Schedule and Amount of Feeding. At the New York Zoological Park turtles are fed three times a week. This appears to be sufficient for normal growth. The amount to be fed must be decided on the basis of the individual turtle. It should be offered all that it will eat at one time, but no food should be left in the enclosure after the turtle has eaten its fill. A period of about two hours appears to be sufficient for most turtles to complete their meal.

Precautionary Notes. Some turtles will eat any or all of the food items listed above, while others are quite selective. You will soon learn the preferences of your particular turtle. However, keep in mind that many species of turtles undergo vast changes in food habits during their life. Some, such as the common Box Turtle, begin life as meat-eaters but become almost purely vegetarian as adults. Therefore even if you find that your turtle tends to confine its diet to one type of food, you should occasionally offer it some of the other elements.

Food to be avoided includes fat meats such as pork or lamb. While there is no direct evidence that the fat harms the turtle, it does foul the container and may serve as a growing medium for bacteria and fungi. The commercial "turtle foods," usually made of dried insects, may not be actually harmful but do not contain sufficient food value to be beneficial.

If a turtle loses its appetite suddenly, you should first check the temperature and lighting of the enclosure — including the water temperature. Suboptimal temperatures are the usual cause. Some turtles seem

to be innately difficult to feed, however. In some cases an especially tasty item, such as a strawberry, a live earthworm or mealworm, or even some rose-petals scattered over the food, will tempt the turtle to begin.

Health Problems

Turtles are notoriously resilient animals and have few problems of health as long as their basic requirements are met. This is fortunate because almost nothing is known about specific treatments for reptilian diseases. However, it may be emphasized that no turtle disease is known to be, or even suspected to be, transmittable to human beings. The few suggestions given here are for the most part empirical in nature and have little or no scientific or medical basis.

Algal Growth. Green algae on the shell is a natural condition in many turtles and is not a health problem. If it appears in the tank, however, it usually means that (1) the tank is getting too much light and (2) there is too much organic material in the water.

Bacterial or Fungus Infections. Whitish or grayish growths on the shell or body of the turtle are a danger sign. The tank and background materials should be cleaned with soap and water, and perhaps a disinfectant. The turtle may be given daily salt baths (solution of $\frac{1}{4}$ teaspoon of table salt to 1 measuring cup of lukewarm water) for 15 minutes per day over about a two-week period, or until the infection disappears. The aureomycin and terramycin solutions used for this purpose in tropical fish aquaria may be helpful also.

Cuts and Bites. Openings in the skin due to injury may be cleaned with a swab and treated with a common antiseptic such as merthiolate or iodine solutions. Mercurochrome appears to be harmful to some reptiles and should not be used.

Moulting of Shell Plates. Pond Turtles normally moult the plates of their shells at irregular intervals. This should not be considered a health problem.

Painted Shell. Lacquer or enamel covering the shell will restrict its growth, causing a warped and misshapen shell, and may actually kill the turtle. The lacquer or enamel should be scraped away with a sharp knife, or carefully removed with a small amount of fingernail-polish remover.

Plastral Sores. Sores on the lower shell are usually caused by a rough substratum. Replace rough rocks with smooth ones; treat sores as under "Cuts."

Roundworms. Roundworms sometimes appear in the turtle tank, indicating an infestation. We are told by Dr. Charles Gandal, the Veter-

inarian of the New York Zoological Park, that one of the Piperazine compounds, administered orally in a proportion of 100 mg. for each pound of turtle, will kill the worms, if they are intestinal in nature.

Running Sores. Occasionally wild-caught turtles, especially Box Turtles, will have an open running sore on the neck or limb. These are often caused by bot-fly larvae, and the maggots can be found by probing. They should all be removed (there may be as many as 20), the wound washed out with lukewarm water and treated with a mild antiseptic. The turtle should be kept out of water until the wound has healed.

Sloughing of Skin. The usual skin-sloughing of turtles is normally not noticeable. If the skin of the feet or tail seems rough and sore, check the sunning-rock, for the condition usually indicates that the animal cannot get out of water so as to become completely dry.

Soft Shell. This most common complaint of captive turtles is curable by the addition of relatively large amounts of calcium to the diet. (See "Food and Feeding").

Swollen Eyes. This appears to be a terminal effect of poor living conditions and diet. Bacterial or fungus infection may play a part. Begin salt treatments (see "Bacterial Infections") and check living conditions and proper diet.

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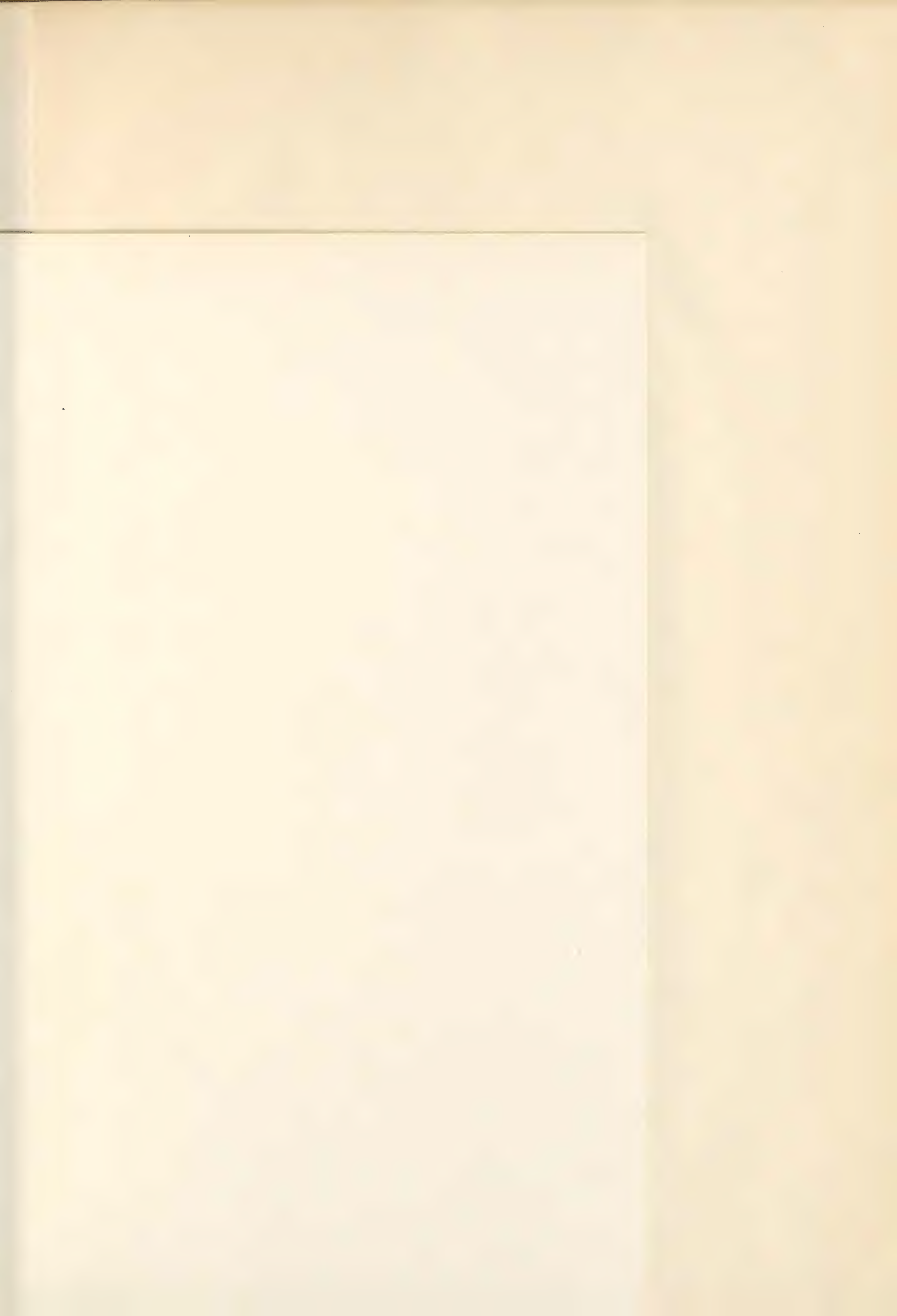
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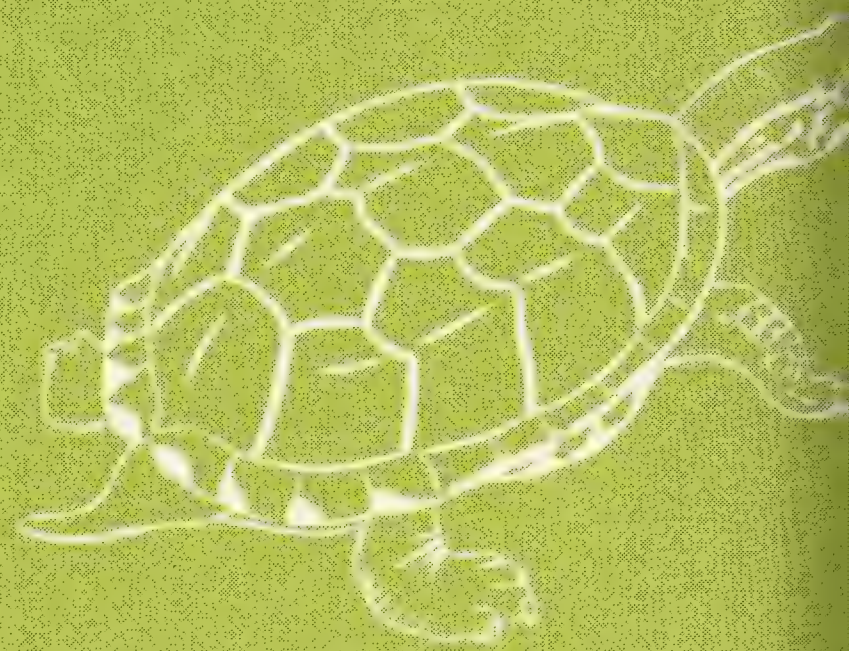
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